

# AVIATION WEEK

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DEC. 6, 1954

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# Aviation Week

DECEMBER 6, 1984

VOL. 47, NO. 29

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Los Angeles 17—2711 Wilshire Blvd., Room Mailbox 4 0201

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52,824 copies of this issue printed

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Aviation Week is owned by Press Association, Inc., a subsidiary of Associated Press

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AVIATION WEEK • DECEMBER 6, 1984 • Vol. 47, No. 29

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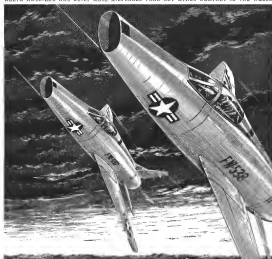
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## Monacaupé Tests New Meteor Businessplane

Evolution and certification tests are under way on the new four-place Monacaupé Meteor businessplane, which is designed for 180 mph cruise speed at 7,000 feet. Two 250-hp Lycoming

new Rotax 4-cylinder props. The altered Meteor carries 73 gal. of fuel in wing tanks. Range with this fuel load is 1,500 mi. Cruising about 1,200 ft., the plane burns 1,993 lbs.

## Domestic

Trans World Airline, according to industry sources, is ready to buy 30 or more new Lockheed L-1011 Super Constellation jets (p. 17). Unit price of the new planes is reported to be about \$2.6 million. A joint announcement from Lockheed, Howard Hughes and Pan Am-Warner was reported in perspective last week.

Garrett helicopters has been test flown by Goodyear Aircraft Corp. at Altus, Okla. Designated GA-606R, it is being demonstrated to the military.

Dr. Theodore Van Korman has won the 1954 Wright Brothers Memorial Trophy for "significant public service in a civilian or military field or aviation in the U. S." The award is made by the National Aeronautics Act.

Turboprop Lockheed C-119A Hercules, USAF cargo assault transport, will fly tonight at direct cost of \$60 cents a mile, with indirect operating costs at half the figure, according to Robert W. Middlebrook, chief engineer for Lockheed Aircraft Corp., Georgia Division. Design payload is 25,000 lb. at 103,000 lb. gross weight.

Tyson Aircraft Corp., Dallas, has received a multi-million dollar contract for Lockheed F1V Neptune wings, extending firm's production of these components well into 1955.

Mackay trophy has been awarded to Strategic Air Command's 416th Air Division for "most successful flight of 1954"—training missions by 25 Ke-

serley F-44 Thunderbolt fighters, during which 17 planes flew 4,451 mi. from Georgia to England and the others flew 4,475 mi. from Georgia to Mexico with no refueling.

Rolls-Royce Dart turboprop engine finalization design was completed last week at Washington, D. C., for personnel of Civil Aeronautics Board and Civil Aeronautics Administration by Kenneth Pickett, chief engineer of the engine firm's Canadian branch.

New flight across the mid Atlantic, with a stop at the Azores, was made by 24 Republic F-84 Thunderbolts of the 508th Strategic Fighter Wing. The 1,000 mi. trip was made in 12 flying hours. Flight refueling was used on the Bermuda-Azores leg.

Sally Atchell will deliver the annual aviation lecture before the New York Finance Exchange (published with the Stock Exchange) for the sixth consecutive year. The aviation industry will be discussed Dec. 7, seventh industry Dec. 14. Atchell is financial writer for AVIATION WEEK.

Procurement information center has been established at Washington, D. C., by Small Business Administration in the Lafayette Building.

## Financial

Cartin-Wright Corp., Wood Ridge, N. J., has declared a 15-cent quarterly dividend and an extra 25 cents on common stock, payable Dec. 25 to holders of record Dec. 7. A fourth quarterly dividend of 50 cents on class A stock

will be paid Dec. 25 to holders of Dec. 3.

For American World Airways reports to Civil Aeronautics Board that its revenues for cost accounting ending Nov. 30 totaled more than \$168 million, up 9% over the same period of 1953. Operating expenses increased less than 31% (million), providing net income after taxes of approximately \$18.1 million, a 10.8% gain. Overall passenger revenue per seat was about 9.9%.

## International

Loss of cabin passenger while at 25,000 ft. when a window blew out was experienced by British Overseas Airways Corp. Boeing Stratojet on route to England from New York, Nov. 29. Crew quickly took plane to lower altitude.

Newmarket was lost or released by British Overseas Airways' Argosy Aerohunter while leaving London for Amsterdam Nov. 28. Pilot made safe landing. None of 15 passengers or crew of 30 was injured.

Wallace R. Turnbull, 54, Canadian passport in the development of considerable parish church property, died Nov. 16 at St. John, N. B.

USSR Academy of Sciences has established the Trofimovskiy Gold Medal to be awarded every three years for outstanding work in interdisciplinary investigations from the Soviet newspaper, Pravda, reports The model is named after K. Ye. Trofimovskiy, founder of interdiscipline, according to the Russians.

## AVIATION WEEK, December 6, 1954

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## WHO'S WHERE

### In the Front Office

Adm. J. J. (Jack) Clark (USN Ret.), former Assistant Chief of Naval Operations for As (1946-47) and commander of the Seventh Fleet since the Korean War, has become a vice president of Radio Receiver Co., New York.

Samuel Gross, former director of labor laws for Radio Receiver Corp., is now president of Grossman Corp., New York.

Nathan Kahan has been promoted by Fox American World Agency to vice president. Voltaire Richard Fisher is now (FAA) manager for the Pacific East.

George A. Platt, Jr., has moved up in American Broadcasting Corp., Cincinnati, Ohio, from engineering director to vice president research and engineering.

H. Webster Gross has been elected a vice president of Arco Manufacturing Corp., New York, will coordinate all defense and industrial sales.

W. Van Neel has been appointed a vice president and director of Arco Corp., Atlanta, Ga.

### Changes

G. Earl Miller, machine engineer and chief creative officer of Pasco Helicopters Corp. and former chief of Pasco Aircraft Co., Glen E. Miller Co. and Republic Aviation Co., has joined Northrup Aircraft, Inc. as executive assistant to vice president John W. Myers.

Kenneth L. Clark is general manager of George Gern Corp. a new subsidiary, Fabulous Metal Products, Los Angeles.

Richard E. Hulings has been promoted to general manager of Minneapolis Electric Corp., St. Paul, subsidiary of Liles Corp., Inc.

Charles Becker has been appointed manager of Cook Electric Co.'s Eastern Sales Division, New York.

Robert G. Borch has become manager for the New York office of Minneapolis Honeywell's Automated Division, Minneapolis, Minn.

R. E. Miller has been moved up by Fed. and Republic of Radio Co., Glenside, N. J., to manager of the service equipment product line.

### Honors and Elections

Dr. John H. Pender, Trusts World As Jones director of As World Education, will receive the Fred G. Bower Trophy Dec. 17 at the annual Wright Brothers Memorial Dinner in Washington, D. C.

Don Horvath, York (Pa.) Airport, is now president of the National Aviation Trade Assn. Other officers: Tom Ferguson, Albany (Ga.) Air Service, nation vice president; King Cross, Cape Airfield, Inc., Houston (Tex.) National Airport, western vice president; J. David Finger, West Chester (N. E.) Airport, treasurer.

Frank E. MacNeil, national vice president of the National Aviation Trade Assn. Transport Assn., is now executive secretary of ATAs Air Traffic Conference of Aviation.

## INDUSTRY OBSERVER

Two new trends in turboprop engine development are the use of rotating stages to provide a constant-speed effect on the compressor and the use of boundary layer control. Both developments are being applied to new high-speed engines by manufacturers on both sides of the Atlantic.

Many will continue its development of vertical thrust and landing aircraft with the use of turboprop and rocket power rather than the turbojet now being used in the Convair and Lockheed VTOLs. Use of the jet blast also is being studied as a means of controlling attitude of the aircraft.

Latest reports indicate that Russia has developed an exceptionally reliable turbojet engine with a range approximately twice that of the German V-2. The German aircraft had a range of about 150 mi. First turbojet engine now reaching production stage in the United States is the Army's Redstone, with a range of less than 200 mi. The Soviet also is working on other turbojet engines with a maximum range up to 1,500 mi.

Failure of Pentagon planners to stick to a set course is one of the major reasons for slowness of missile development. "Ability of equipment" was a top criterion, "in any bigger hardware. We have got under way on a project when down more criteria changing the entire concept and we have to start all over."

Westland Aircraft, Ltd., of England will build the two-engine Sabrejet 5-14 in the future plant under license from the American manufacturer. Westland's 5-14 will be called the Westland Sabrejet and offered for both military and commercial use.

Airbus Division of General Motors Corp. has delivered more than 10,000 J33 centrifugal flow jet engines to Air Force and Navy since 1945.

Douglas Aircraft Co. is modifying a C-124 Globemaster to take an experimental Pratt & Whitney T57 turboprop. The engine is expected to be in the 15,000-hp class and is estimated to power the Douglas C-124 together current rated at a 100,000-hp payload.

Roll-Rover, Ltd., is developing a supercharged turboprop to meet the requirements of the Royal Air Force. The engine is expected to be in the 15,000-hp class and is estimated to power the Douglas C-124 together current rated at a 100,000-hp payload.

Naval Division of English Electric is making a bid for the entire turboprop market, offering its 1,500 hp Eland for Convair 440 and Amphibious Amphibious engines. Navier has bought a Convair 440 for modification of two Elands and plans to push the conversion among present order customers of Convair before any other manufacturers' turboprops are obtained. Navier also plans to install two Elands in an Amphibious early next year and hopes to attract British European Airways, now operating piston-powered versions, in the conversion. Navier also is developing a 1,500 hp version of the Eland turboprop.

Post of New York Authority is thinking in terms of four-engine helicopters in planning amphibious helicopters. Only four-engine helicopters will be used and four-engine amphibious is available.

Sole Flight Instrument Corp.'s stall indicator is being installed in the Fairchild C-73.

Army now estimates it has more than 12,000 jobs authorized for helicopter maintenance specialists.

Heavy cranes Boston and Canham will be put into operation during 1955 by the Navy at the first combined general mobile ship of this type.

### Electronic Computation of Payroll and Cost Record Data Explained in Free Booklet

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## Ayro-Canada To Be Three-Company Group

Three independently operating units have been created by A. W. Roy, Chairman, Ltd., from the company's Aircraft and Gas Turbine Divisions and a newly acquired permanent leasing firm, Canair, Ltd. The new group, Canair, Ltd., is now operating as a separate unit.

New organizational setup, designed to maximize individual growth and achievement, becomes effective Jan. 1.

A. W. Roy, Chairman, Ltd., becomes the parent company of the three members which will be known as follows:

• **Aero Aircraft, Ltd.**, focused out of the Aircraft Division and employing about 10,000.

• **Canada Engines, Ltd.**, from the Gas Turbine Division, currently employing about 6,500.

• **Canadian Steel Improvement, Ltd.**, the new acquisition, employing about 400.

Each of the companies will have its own board of directors and financial, legal, industrial and public relations functions—except for overall policy and coordination.

Officers—Sir Roy Delton, a chairman of the parent company, vice-chairman is Air Marshal W. A. Carter, and president is Canadian General, J. G. O'Brien, heads of the three subsidiaries: Aero Aircraft, Paul T. Sorey, Canada Engines, Walter R. McLaughlin, and Canadian Steel Improvement, Cyril J. Lodge.

Several key vice presidents are retained. In the leasing company, they are: Charles A. Baker, Toronto, and W. H. O'Brien, industrial relations in Aero Aircraft, J. C. Boyd, business vice president manufacturing, and J. A. Marley, sales and service, in Canada Engines. C. A. Gray, business vice

president engineering, E. K. Brown, chief manufacturing, and F. E. Tindall, sales and service, in Canadian Steel and Improvement, J. A. Whitting, business vice president operations.

## Feeder Plea

• **Barnes asks liberalized profit margins for locals.**

• **And he says CAB should end uneconomic services.**

A change in Civil Aeronautics Board's philosophy to speed the elimination of subsidies for local service routes was proposed last week by Leslie O. Barnes, president of Allegheny Airlines. Barnes proposed:

• **Most local profit margins** based on the percentage of profit figured on income rather than on investment. This would mean the immediate subsidy but freedom would reach the subsidy-free goal sooner.

• **Suspension of service** at uneconomic points until revenues, including a new system of subsidy, do not meet the cost of operating costs and profit.

• **Airline mergers**, which must operate with the current, must be encouraged by CAB.

• **Review of subsidies** of losses to track costs.

• **Lithenization of policies** on allowable expenses, such as sales advertising and promotion. Present limitations on advertising budgets are "arbitrary," he said.

• **Ways to govern**, Barnes said, "be a set of necessary and feasible costs and scheduling restrictions de-

signed to protect the trunk airlines from competition by the local service carriers." The cited Allegheny's route between Pittsburgh and Atlantic City, where three stops are required along the route although it is the only airline operating between these points.

• **Star Program**—Elimination of these operating subsidies will lower costs and increase revenues, he said. "But progress is slow. That the Civil Aeronautics Board has not come to grips with this problem is understandable."

The Board is faced with the dilemma of trying to protect traditional line uneconomic competition. "On the other hand," he added, "the Board is obliged to do all possible to strengthen the local service carrier. However, the need for a final Board policy is immediate."

Barnes said the trunk lines are going up against certain points to further because of the possibility that the local service airline with the new routes might be absorbed by a competitive trunkline.

"If this should happen," he said, "the operation of that route by the trunk acquiring the local carrier might place the regionalized trunkline at a competitive advantage."

• **Rebated to Air**—Because of the lack of a clear policy defining the role of the local carrier, trunklines are reluctant to yield any more ground. This, Barnes believes.

"Without a firm policy, then there is but a part of succeeding steps and that the line may come when the local carrier will become strong competition over the most valuable routes of the trunk carriers," he said.

• **Three-Way Plan**—Barnes offers a three-way plan to overcome these difficulties.

• **The airlines can attain a long run of agreement** in developing a flexible pattern of operating and scheduling restrictions with their factors permitting.

The pattern would define the necessary restrictions necessary to protect the trunk between the same level routes. It would not define precisely the circumstances under which a trunk could be suspended in favor of a local service carrier.

• **Policy action** should be set up by the Board to cover the disposition of routes and stages yielded by a trunk carrier in the event the local carrier was absorbed by a trunk other than the one yielding route. In such an event, the points in routes would revert automatically to the yielding carrier.

• **Each local service airline** would apply such a policy to its own system. Following a study by a panel within its own organization, it would be recognized with the trunk carrier who might be interested so that the carrier could put out its case to CAB.

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Varig	World	Trans World
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Virgin	World	Trans World
Wendair	World	Trans World
World	World	Trans World



## Piasecki's Giant YH-16 Tops 130 Mph.

Piasecki Helicopter Corp.'s twin-engine YH-16 Transporter has exceeded 130 mph, doing take-off and climb to 1,800 ft. in less than 10 sec. USAF expects test over Philadelphia.

plus doing a climb-out test mission. The YH-16's PAWA R2180 piston engine, will be moved and replaced by two Allison dual turbo-prop engines (Vought West No. 8, 7)

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## Civil Aircraft Shipments Increase

Aircraft shipments during September totaled 900,000 lb., increased by 10 percent over August, Department of Commerce reports. Unfilled orders for civil aircraft with airframe weights of 5,000 lb. and more were 124, a 21% increase over the previous month's backlog.

	September 1954	August 1954	September 1953
Completed aircraft	265	264	199
By weight of airframe			
Less than 5,000 lb.	234	246	193
5,000 lb. and more	31	18	20
By number of places			
1 to 5 places	221	197	151
More than 5 places	43	27	26
By total hp., all engines			
Up to 100 hp.	200	191	155
400 hp. and more	37	10	26
Total value of completed parts (500 costed)	\$16,543	\$15,247	\$13,257
Aircraft	16,156	15,795	13,047
Less than 5,000 lb.	4,400	5,359	2,957
5,000 lb. and more	11,756	10,436	10,090
Aircraft parts	3,387	6,452	9,210
Total of aircraft engines and parts (500 costed)	9,511	10,405	15,073
Aircraft engines	1,192	4,410	7,221
Engine parts	8,319	6,195	7,852

## Lab to Study Gunfire Effect at 60,000 Ft.

The effects of high-explosive shells on aircraft at high altitudes and high speeds will be studied in a new dynamic test cell to be constructed at the Arnold Engineering Development Center, Tullahoma, Tenn.

An Research and Development Command has awarded a contract for the design of the new cell to the New York firm of Grunow, Conkling & Associates.

Current plans call for the new test cell to provide wind-tunnel generation for incendiary or high explosive shells fired through a subsonic velocity rate

typical wing surface of an aircraft. Gunfire or jet fuel will be stored just below the wing to simulate actual installation.

Complete instrumentation, including telemetry and motion picture cameras, will photograph the behavior during impact and of the resulting fire. Tests will be made up to simulated altitudes of 60,000 ft. and with a temperature range extending between -60°F and +150°F.

The cost of the test facility will be handled by the crew in the adjacent Engine Test Facility, working in the far central area. Armor plate and composite wall around the new cell to confine the blast.



## Fully Loaded Mystere Dives Past Mach 1

An Indian air force pilot recently dove the French Dornier Mystere 4A past Mach 1. The lightweight jet fighter carried maximum, two machine gunning loads and two tanks of napalm. It was the pilot's first flight as the Hispano-Suiza T-12 powered 4A.



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## Tool Leasing System Under Fire

Congress committee urges all services to set price standards on machines used in defense production.

Standard leasing rates for government-owned machine tools used by defense production contractors is urged by the Joint Congressional Committee on Defense Production.

The committee's review of procedures involved in furnishing machine tools reveals there is no standard policy followed by Air Force, Navy and Army.

► **Lack of Standards**—It is primarily the responsibility of the individual contracting offices in the three services to determine what tool, if any, should be furnished to the contractor and on what basis, the committee reports.

"When prime contractors have required tool, it has been the general practice to furnish the tool under a separate facilities contract. Under this procedure there has been no uniform standard for determining the value of the tools to be furnished and, therefore, no consistent policy in effecting a reduction in the production price."

Costs derive from the contract for include:

► **Contracting offices** frequently are not informed of the acquisition cost, age or

condition of tools in quantities and do not have a factual basis for making a proper price adjustment.

► **Negotiations** frequently are based on the contractor's estimated value of the tools required and not on actual tools furnished.

► **Cost Advantage**—Indications are that contractors using government tools may enjoy distinct advantage compared with the contractor leasing capital equipment in his own tools, the committee says.

This is particularly true where a contractor has more than one contract utilizing the same tools. Contractors supplying similar items may find that one enjoys a better profit position as a result of operating a better deal on the tools concerned.

"Moreover, the actual government cost of the product to the government is hidden in the tool-adjusted price contract, and there is no way to make a direct comparison as to which contractor is giving the government the best deal."

► **Lease Charges**—The government-owned tools usually are leased by the

armed services on a monthly rental basis. The rate generally is based on 15¢ per month (48-hr. week) of the original acquisition cost regardless of age or condition of the tool.

Defense Department faces the problem of determining a fair rental rate.

"The general feeling in some quarters," the committee says, "is that government rates should be brought down in line with commercial rates. However, the point is made in other quarters that since the government is not in the business of leasing tools at such and since the only reason the government furnished any tools is to increase defense production in an emergency, industry should not object to the 15¢ where defense work is involved."

The committee reports the armed services have approximately 460,000 tools and related equipment in use or on standby basis in military establishments and private defense plants. There are an additional 31,000 idle military tools in the defense industrial equipment stores.

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Los Angeles—The experiment in transporting airmail first-class mail by air on a space-available basis extended

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Circle 10 on Reader Service Card

to the West Coast Nov. 22, lands 17 proposed cities in California, Oregon and Washington.

The new service is expected to speed delivery of mail from 24 to 46 hours to these cities.

Acting Los Angeles Postmaster Otto K. Olson predicts the West Coast operation will handle about 3 million letters daily.

► Cities involved—Cities directly being fitted by the Sprint night include San Diego, Los Angeles, Berkeley, Fresno, Phoenix, Stockton, Sacramento, San Francisco and Oakland in California; Kansas City, Portland, Eugene, Salem and Portland in Oregon; and Seattle in Washington.

Additionally, hundreds of smaller cities near these points will benefit by better mail service, the Post Office Department says.

The West Coast operation follows similar experiments in 3-out air service established among Chicago, Washington, New York and other major Florida cities and, by local service lines, to communities in 25 states.

► Ready, Willing—Regular Sprint air mail service that guarantees air transportation on scheduled flights will in so far be affected by the new Sprint air service, Postmaster Olson says.

Tosell C. Deschamps, president of Western Air Lines, reports his company is "ready, willing and able" to handle the new Sprint service.

"At the West's major trunk routes, Western considers the Sprint transportation of mail vital to the continued development of the federal government, most prominent region in the nation . . .," he says.

### Southwest Prepared To Expand Navajos

Southwest Airlines is prepared to spend \$150,000 to purchase and install auxiliary radio aids at all points on its Route 76, if it receives a permanent certificate as its aircraft now now pending before the Civil Aeronautics Board, according to vice president Max King.

The program will include installation of Instrument VOR, range, glide path transmitters, distance measuring time meters and responder, VHF auxiliary and high intensity lights, he says.

The degree of dependability necessary to support full public confidence in schedule reliability can be attained by the installation of modern aids and by improvement of marginal airports to accommodate landings under the lowest safe ceiling and visibility conditions. The weather minimums could not be inferior to those found at major airports," King adds.

He emphasizes that "at this stage of the development of local service, the

second problem is secondary to that created by the lack of navigation and landing aids.

"In local air transportation, the effect of unreliability is usually more serious than in other modes of transport," he says, "because of the local advantage local service enjoys over surface competition. A passenger who misses an important engagement 191 mi. away is much more likely to change to the train, bus or private car for the next trip than the transcontinental passenger who would forfeit days rather than hours to go by surface."

"We have estimated," he says, "that between \$68,000 and \$115,000 per

year additional revenue could be generated on Route 76 from improved reliability and regularity to be obtained from the installation of modern instrument navigation and landing aids."

### Spanish-Built Jet

(McGraw-Hill World News)

Mahid—A prototype of an advanced jet trainer is under construction at Hispano Aviacion, Seville.

The new jet, Spain's first, has two engines mounted in the wings. A single-seat fighter version is on the drawing boards.



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## Noise Intensity Hits F-100 Line Crews

George A. Force Base, Calif.—A study of the effects of jet engine noise on astronauts over here has begun following complaints at this base that stress is making the F-100 an interfering force and even in the crew.

Squadrons have now are receiving North American Aviation's first operational F-100.

Effects of the high sound level are both physiological and psychological, Capt. Vernon Perry, USAF medical officer, says.

Many of the complaints concern the stress level with the F-100, which develops a level of 117 decibels.

► **Competition**—The F-100 and its Pratt & Whitney Aircraft JT7 engine produce 160 decibels at the tailpipe and 120 decibels at 1,300 ft. Dr. Perry says.

Any sound of sufficient level or intensity can cause damage to the ear and also internally, he says.

He lists three physiological effects of sound.

► **Heat**—Sound can increase the temperature of the body. Ultrasonic sound, for example, can raise the temperature from 80 F. to 160 F. in one minute.

The F-100, however, does not produce ultrasonic sounds of any high intensity, Dr. Perry says.

► **Breath**—In the intensity, tension, joints at both.

► **Pressure**—Increase in the skin can be felt at 120 decibels, and the subject can feel the pressure.

► **Shall**—and presumably what's in it—begins to vibrate at 140 decibels. Vibration also can be felt in the abdominal muscles.

He lists three psychological effects.

► **A sound level of 140 decibels can make a person unconscious.**

► **A sound level of 80 decibels can produce nervous fatigue, headache and slight abstract thinking.**

► **Destructive changes and effect on hearing can begin at 120 decibels.**

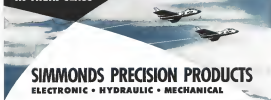
In more than 5,000 tests at this base since last February, Dr. Perry reports, these have been found to be believed to be having their bearing due to the effects of flight test noise.

► **Some Inmate**—Squadrons at George have been operating F-100s prior to receiving F-100s.

Results of the tests thus far are conclusive concerning the F-100, Dr. Perry says, but indicate there are certain persons not bothered by the sound, others severely affected by it. The world indicates, he says, that sensitivity to sound might become one criteria in selecting line personnel.

Use of earplugs, earplugs and earbuds reducing the level of the sound down to a bearable level, he says.

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F-86H SABRE JET is more powerful fighter-bomber with improved climb and range. Deeper fuselage houses G40 J73 engine.

## F-86F Sabre Undergoes 2-Way Stretch

Here's how North American spliced in additional depth for more powerful engine in F-86H, additional length for second cockpit in TF-86 trainer.

By David A. Anderson

Los Angeles—No matter how you slice it, it's still the power F-86F. • **Show the F horizontally**, splice in extra fuselage depth, and it becomes the F-86H, an improved fighter-bomber and day fighter now coming off production lines at North American Aviation, Inc.'s Columbus, Ohio, plant. • **Show the F vertically**, add some fuselage length, and it becomes the TF-86, a two-seat trainer with performance of the F-86F.

Details of these two late modifica-

tions of the best Sabre fighters were told in *Airweek* by engineers at NAA's headquarters here.

### F-86H Sabre Jet

The H Sabre is none of an airplane than the F, says North American. In climb, range and load factor, the H shows improvements all along the line. It is an airplane to which the classic comment about putting up the gas and rolling in a new body could be applied, because with the exception of the landing gear, all the basic structure is different and strengthened.

But pilots who fly it should feel right at home because it retains the handling characteristics of the F series.

► **Powerplants**—The basic difference is the H series is the engine, a General Electric J73-GE-1, rated at approximately 5,000 lb dry sea-level static thrust. This represents about a 50% increase over the thrust of that company's J47-GE-27 that powered the F-86F.

This increase in thrust was accomplished without any increase in engine front area, although the use of the engine case did increase the envelope dimensions of the powerplant.

But more than nose area up, and the duct area of the F-86F were at its apex. Just for the size of the engine, North American engineers were faced with passing some solid area in duct cross-section, and they solved that problem by splitting the fuselage lengthwise along a diagonal water bar and splicing in an extra six inches of fuselage depth. (A similar casing change was made in the *Arrow* Sabre built in Australia because of the increased air requirement for the Rolls-Royce Avon. Details of that operation were given in *AVIATION WEEK* Feb. 8, 1954, p. 32.)

► **Other Changes**—More power and fighter-bomber requirements spell out more fuel. The H retains the wing cell layout of the earlier series, but adds fuselage fuel for a total increased capacity.



SIDE VIEW OF F-86H shows depth spliced into fuselage for extra air capacity required by the J73 engine. Australia made similar change in *Arrow* Sabre.



FIRST F-86H on the experimental prototype line at NAA's Los Angeles plant.

Official measurements on the F-86H state the increased in the stand air requirement of an 800-hp engine, but it is understood that Kansas could test made with specially fitted F-86F's have been selected as most appropriate for the H. Presumably the plane will sustain load of the new M-79 53-mm submachine gun.

Reaction, boost and other wing items can be carried, and the company says that suspension and engine mechanisms for these items have been improved.

Carriage and engine equipment because the same as in the F-86F, but the duct redesign has meant a somewhat larger cockpit. The company says the layout is important, there is a divided in expanded pilot's vision. One other cockpit change is in the escape, designed now as a standard type to replace the familiar sliding style of the earlier Sabres.

► **New Tail**—In most respects the new tail and vertical tail surfaces resemble those used on the F-86D all-weather interceptor. There is no dorsal fin in the horizontal tail, which is the "tail-fine" type possessed on the F-86F. Its span is about two feet greater than on the tail of the F series, giving greater area as well.

Power controls are hydraulic for the elevator and ailerons, there is no power on the rudder. Controls are reversible,

basically the same as on the F-86F airplanes.

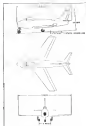
With these and the preceding airframe, the pilot now has a 7.51G up-plate at combat weight.

Specific combat performance is claimed, the *Avon* has only the usual standard—speed is more than 600 mph at sea level, tactical ceiling is more than 600 miles, and service ceiling is more than 45,000 ft.

Some statistics of the plane's actual performance was given at the Dryden test show in September. Major John L. Armstrong, art a world record in the 500-kilometer closed course of 649.162 mph; the Thompson Trophy event was won by Capt. Eugene F. Sweeney, who flew an H over the 100-km closed course at an average speed of 497.023 mph.

► **Current Status**—Production models of the H are being built at the Dryden plant, although the first two planes off the line were made at the NAA plant here. All engineering of the new model is controlled from company headquarters, under Fred Peck, project engineer on line of the Sabre series (F-86A, F, H and the TF-86).

Planes are currently being delivered to operational squadrons at Nichols AFB (Air Training Command) and Chase AFB (Federal Air Command) as a double-barreled program under to that



F-86H SIX INCHES DEEPER



TF-86H SIX FEET LONGER



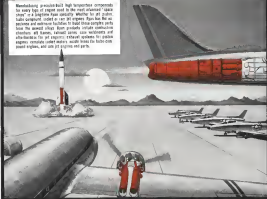
TF-86H TRAINER shows Sabre ancestry in basic line, modified to include a second cockpit. Vertical fin for additional stability.





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		Empty	Max				
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Model 200	Jet	2,000	2,400	2,000	2,000	2.0	2.0
Model 300	Jet	3,000	3,600	3,000	3,000	3.0	3.0
Model 400	Jet	4,000	4,800	4,000	4,000	4.0	4.0
Model 500	Jet	5,000	6,000	5,000	5,000	5.0	5.0
Model 600	Jet	6,000	7,200	6,000	6,000	6.0	6.0
Model 700	Jet	7,000	8,400	7,000	7,000	7.0	7.0
Model 800	Jet	8,000	9,600	8,000	8,000	8.0	8.0
Model 900	Jet	9,000	10,800	9,000	9,000	9.0	9.0
Model 1000	Jet	10,000	12,000	10,000	10,000	10.0	10.0
Model 1100	Jet	11,000	13,200	11,000	11,000	11.0	11.0
Model 1200	Jet	12,000	14,400	12,000	12,000	12.0	12.0
Model 1300	Jet	13,000	15,600	13,000	13,000	13.0	13.0
Model 1400	Jet	14,000	16,800	14,000	14,000	14.0	14.0
Model 1500	Jet	15,000	18,000	15,000	15,000	15.0	15.0
Model 1600	Jet	16,000	19,200	16,000	16,000	16.0	16.0
Model 1700	Jet	17,000	20,400	17,000	17,000	17.0	17.0
Model 1800	Jet	18,000	21,600	18,000	18,000	18.0	18.0
Model 1900	Jet	19,000	22,800	19,000	19,000	19.0	19.0
Model 2000	Jet	20,000	24,000	20,000	20,000	20.0	20.0
Model 2100	Jet	21,000	25,200	21,000	21,000	21.0	21.0
Model 2200	Jet	22,000	26,400	22,000	22,000	22.0	22.0
Model 2300	Jet	23,000	27,600	23,000	23,000	23.0	23.0
Model 2400	Jet	24,000	28,800	24,000	24,000	24.0	24.0
Model 2500	Jet	25,000	30,000	25,000	25,000	25.0	25.0
Model 2600	Jet	26,000	31,200	26,000	26,000	26.0	26.0
Model 2700	Jet	27,000	32,400	27,000	27,000	27.0	27.0
Model 2800	Jet	28,000	33,600	28,000	28,000	28.0	28.0
Model 2900	Jet	29,000	34,800	29,000	29,000	29.0	29.0
Model 3000	Jet	30,000	36,000	30,000	30,000	30.0	30.0
Model 3100	Jet	31,000	37,200	31,000	31,000	31.0	31.0
Model 3200	Jet	32,000	38,400	32,000	32,000	32.0	32.0
Model 3300	Jet	33,000	39,600	33,000	33,000	33.0	33.0
Model 3400	Jet	34,000	40,800	34,000	34,000	34.0	34.0
Model 3500	Jet	35,000	42,000	35,000	35,000	35.0	35.0
Model 3600	Jet	36,000	43,200	36,000	36,000	36.0	36.0
Model 3700	Jet	37,000	44,400	37,000	37,000	37.0	37.0
Model 3800	Jet	38,000	45,600	38,000	38,000	38.0	38.0
Model 3900	Jet	39,000	46,800	39,000	39,000	39.0	39.0
Model 4000	Jet	40,000	48,000	40,000	40,000	40.0	40.0
Model 4100	Jet	41,000	49,200	41,000	41,000	41.0	41.0
Model 4200	Jet	42,000	50,400	42,000	42,000	42.0	42.0
Model 4300	Jet	43,000	51,600	43,000	43,000	43.0	43.0
Model 4400	Jet	44,000	52,800	44,000	44,000	44.0	44.0
Model 4500	Jet	45,000	54,000	45,000	45,000	45.0	45.0
Model 4600	Jet	46,000	55,200	46,000	46,000	46.0	46.0
Model 4700	Jet	47,000	56,400	47,000	47,000	47.0	47.0
Model 4800	Jet	48,000	57,600	48,000	48,000	48.0	48.0
Model 4900	Jet	49,000	58,800	49,000	49,000	49.0	49.0
Model 5000	Jet	50,000	60,000	50,000	50,000	50.0	50.0

PERFORMANCE SUMMARY—Five TF-66 engines in various loading patterns.

airfield fuel are featured in the trainer, as they are in the later Sabers. A drop-in chute can be built in, the company notes, for pilot ejection in landing techniques involving use of a drop parachute.

Components in installations common to both the trainer and the F-86 are propshaft, afterburner, hydraulic units, landing gear, missiles, ducts, radar and gunpoint combinations. The latter landing gear is identical with those of the early F-86, and major modifications permit interchangeability with the later and heavier jet trainers.

► Basic Mustang—To quantity training, two 30-in. engines, just past 100,000 hours per gun are installed in the nose, located similarly to the lower gun nose

and in the Sabers. The installation of armament comes in a complete kit, including the AN/APG-30 radar parts, the A-4 gunlight and the N-9 rifle camera, as well as mounted bits and pieces and low-velocity tools.

For fighter bomber training, there are other kits either a set of basic sub-assemblies, or eight 3-in. RIVAR launchers. The same armament system carried by the F-86 can be fitted by the trainer.

For "non-landing" practice, two internal fuel tanks of 200-gal. capacity each can be fitted; the trainer then has better than two hours' endurance. This would compare to about 20 seconds of the field under normal operating conditions.

## AF Studies Problem Of Too Much Oxygen

Hyperoxygenation—over-bathing of oxygen—is being investigated by the USAF at Wright and Big Spring AirFs, Tex., because of the suspicion among flight surgeons that some mysterious accidents may have been caused by the phenomenon.

Noted in anatomy, hyperoxygenation can result in dizzy spells, impairment of vision, erratic motor reactions and the glass in hands and feet.

With pressure-breathing oxygen equipment, the source pilot with acclimation becomes a set-up for hyperoxygenation.

It works this way. Normal breathing carries oxygen to the lungs and carries away the waste carbon dioxide. But there has to be a balance, because some carbon dioxide is necessary for proper functioning of the brain.

With pressure-breathing equipment,

oxygen is forced into the lungs, and the pilot has to use his diaphragm to rebuke, which is completely the wrong of not and instinctive breathing. If he's anxious for a shot at a target, or reacting to a difficult flight maneuver, it's easy for him to breathe deeply, and harder for him to rebuke. Under the strain of the moment, he does not maintain the normal pattern of breathing, and hyperoxygenation may result.

Dr. Robert F. Clark, Jr., head of the School of Aviation Medicine's department of physiology, head of a team that developed a breathing instrument for sampling the oxygen intake and carbon dioxide output of a pilot. Tested at Randolph AFB by instructors of the 1,101st Flying Training Group, the meter is being used by Capt. Thomas Puffer, chief of the 7th TFW's Avionics Physiological Division and a jet pilot himself, at Webb and Big Spring.

Out of their teeth, the USAF hopes to learn the symptoms of and the countermeasures for hyperoxygenation.

## ROBINSON WIRE TWISTER now in 2 sizes!



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## the man from Esso ... the refueling crew man

This familiar Joe, Jack or Giovanni and his fellow Esso crew men around the world are important men in the aviation industry. The quality of their services and of the products they deliver is backed by more than half a century of world leadership in the research and development of aviation petroleum products.

Esso refueling crew members are trained specialists who are proud of their jobs. They know that safe and efficient servicing means faster turnaround for aircraft. Operators of leading international airlines rely on Esso standards for uniform high quality of fuels, lubricants and service along the airways of the world.

Another good reason why  
of all the World's International  
Airlines... 8 out of 10 use



of a light is negligible, Navy says.  
The dart was designed by Leonard  
Seelye, project director.

## THRUST & DRAG

The JC maneuver is an intricate deception of a flight path calculated to confuse adversaries. It has been commonly described in short, later Anglo-Saxon words and in the flowery phrases of flight test reports. Like so the words of a Navy lieutenant on exchange duty, quoted in Naval Aviation News after his first ride in a North American Aviation F-86D.

"... and there I was in takeoff position. . . . I went into afterburner (which got about halfway the last half). I missed the hook and the next thing I knew I was in the air going straight up."

"After getting the gear and flaps up, I leveled off at about 1,500 feet to pick up climbing speed. Not out was here I got into it, but it was just like the boys and only more so. Up until then I'd wondered what the term 'JC' meant."

"After it was all over, I was free. He was with me and he helped me out. I believe I pulled in a little back talk (which is delayed). I didn't get an immediate response, so I went back on the stick, and at the same time the time took hold. As this was too much back stick, I pushed it forward rapidly and there I was."

"If you're ever ridden on a wild Barbican ball, you'll have more idea of the JC as a Dog. There were only four or five violent revolutions, but they were enough to send the accelerometer to minus two and plus eight Gs, and lose about 4,000 ft. of altitude."

"When I recovered (by coming out of afterburner and turning loose the stick), I was upside down in a nose-down attitude. Being so big, I can reach almost everything in a cockpit with the shoulder harness locked, and so I'm as a habit of always flying with it locked. I believe it really paid off this time. I was literally thrown all over the cockpit and over for a week afterwards. Had I not been so snugly strapped in my seat, I really would have been severely shaken up."

"Exemplification is the little parent of error."—From transcripts of military flying the Command Inquiry

"Military pilots are only there to beat the postman—Get, Fast, Throttle and End Over."—Recent General Electric presentation by H. T. Robinson of GE's Small Aircraft Engine Dept.

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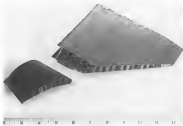
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**HAZING OF SKIN TO CORE** makes possible all-metal honeycomb sandwich. Experimental work shows that all changing core and skin (in actual) have tapered core. Aftermore shown, right, is believed to be lightest commercial part made of this material.

## All-Metal Honeycomb Beats the Heat

By Irving Stone

In the long line of aerospace advances, high-strength, low-weight structural materials always have been the goal.

Now, the greatest jet and rocket

engines for aircraft and missiles introduce a new factor—temperature—on considerations of material strength and weight.

► **Hotter, In and Out-Temperature** are being handled both inside and outside of aircraft and missiles. Increasing

speeds are raising skin temperatures at a rate of air friction and compression inside the vehicle, jet engines and afterburners, ramjets and rockets are great heat sources, which must be associated with temperature-resistant materials.

Thermal stress does pose a problem for plastics up to 500 or 600°F. Stainless steel and other high alloys show great promise for higher temperature applications because of strength and oxidation-resistant characteristics, but their relatively high weights pose a problem. This possibly may be circumvented in a number of applications by the use of honeycomb structure.

► **Sole's Studies**—All-metal honeycomb sandwich construction, so new that no known applications have reached the practical stage, is now offering a practical solution for elevated temperature applications up to at least 1,500°F.

A development program to produce such honeycomb structure by means of high temperature, multiphase joining techniques is underway at Sole Aircraft Co., San Diego. Honeycomb sandwich, using adhesive rather than metal, bonding in skin to core, has been produced in such applications as the Martin B-61 Modulo missile.

Current studies on all-metal and sandwich construction include basic design, new manufacturing and processing methods, bearing material studies, production joining techniques (physical testing and non-destructive).

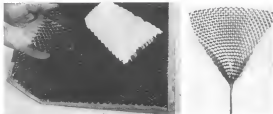
► **Possible Uses**—Data on high temperature



**WILDLY SHIRRED** core and skin. The core 4-in. 2- and 3-dimensional curves.



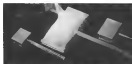
**FLATABLE CORE DESIGNS**—Left, basic corrugated square cell core; middle, Wipac, for deeply corrugated parts; right, endotherm core utilized with longitudinal ribbing.



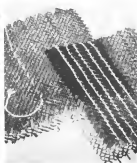
**TWO APPROACHES TO CORRUGING**—Left, core is formed in air for rollings; right, core is collapsed to expand surface.



**OPEN MODES** permit fluid flow or heat transfer here.



**ANOTHER FLUID FLOW DESIGN** has porous face.



**THREAD** indicates fluid channels in modified structure.

ture, directed sandwich structures were presented recently at the Society of Automotive Engineers' Los Angeles Aerospace Meeting by John V. Long, director of research at Sole and George D. Carmichael, the company's senior staff engineer.

These engineers feel that all-metal sandwich structures should find broad application in industry, should be considered for the following applications:

- **Airframes**. Applications envisioned in this category include skin, leading-edge compressive light control surfaces, wing tips, dive brakes, belly landing gear, helicopter blades,

pressure doors, interiors, heat shields, integral fuel tank structures, fire walls, airframe structures.

► **Modules**. These have not projected for skins, fire, noise screens, and interior components.

► **Engines**. Applications seen in this category include gas turbine, compressor casing, compressor and turbine shrouds, and engine thrust components.

► **Missiles**. Included here are gas turbine, solid, shell, nozzle, fluid heat exchangers, still insulated ducting, insulation shields, vacuum flasks, associated structures, explosives (field).

structures, and nuclear reactor structures.

► **Characteristics**—High temperature, all-metal sandwich structures can be fabricated successfully by using special joining techniques, Long and Carmichael say. The resulting structure, they report, exhibits these desirable properties at elevated temperatures:

- High strength-to-weight ratio.
- Extremely high surface factor.
- Good thermal resistance.
- High vibration damping ability.
- Excellent fatigue resistance.
- Acoustical insulation.
- Sandwich Details—A high temperature



# Valve Talk

for WM. R. WHITTAKER CO., Ltd.

By ARTHUR ALLEN

Senior Member, Aviation Writing Area



Whittaker is making its progress payment program—and extending a sincere "thank you" for the cooperation of its long-standby customers.

No new orders accepted by the company since November 1 have been subject to such payments, and effective New Year's Day no progress billings will be submitted against any orders.

Termination of the program is the result of consistent and conscientious Whittaker effort to establish this financing method, an objective that has been attained at the earliest possible date.

It was late in 1951 that the company—facing the expanded production—found itself "in the middle," so to speak, faced with skyrocketing defense orders, but unable to maintain the constant inventory increases required by such production, roughly two and a half times shipment value.

This was "high" production, aerial from stock, but even should current for customer orders, the month of average design, engineering skill and machine tooling intensity.

Instead of coming critical production for the way may not, Whittaker worked steadily to meet the increasing demand and credit to maintain its V-Loan, already repaid—despite to come along steadily deliveries.

Progress under the V-Loan called for customer payment 30 days after a shipment was received. Under this payment plan, claims were billed (90 percent) semi-monthly on the basis of applicable inventory in process, assembly labor, factory overhead and engineering and administrative overhead.

The billings did not include new material, inventory most in process or current parts, approximately 45 percent of Whittaker's total inventory.

The loan used for progress payments can be seen in the company's financing figures which rounded sales of just \$18,000,000 for fiscal 1951, jumping to over \$15,000,000 in fiscal 1952, and over \$18,000,000 in fiscal 1953—a real increase that was consistent and figures correctly to require the overall necessary worth over \$4,000,000.

In other words a small company that sustained almost outright through monthly liquidation of product and ability to deliver on demand was forced—temporarily by these very shipments and progress payments to continue a real production job.

Options to the Progress Payment plan were considered in some instances, but in each of these cases the plan was accepted when the customer became thoroughly acquainted with the financial situation facing Whittaker.

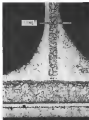
Once engaged in the plan, Whittaker did everything in its power to expedite the program as smoothly as possible, even engaging outside public accountants to make all billings and checks—just not to make any money through handling the debt involved.

In coming months the company's financial picture was improved considerably in an effort to decrease the initial possible moment when progress payments had to be liquidated. In the spring of 1953 billings were directed by contract, but it was because credit on the company's part was still too great.

In the fall of the same year, however, when payment of Federal income and estate taxes was due, Whittaker was able to renew the progress payment program and by analysis of cash position indicated that after substantial tax payments in June and October of this year complete liquidation of the program could be undertaken.

The analysis was accurate, the statement verified.

President Bob Whittaker has announced the successful achievement of all progress payments—and extended the company's most generous consideration for understanding and cooperation on the part of those who buy Whittaker valves.



IDEAL CORE-TO-FACE JOINT desired in high quality valves

Strength per unit weight versus temperature the superiority of T7 T81 steel line steel is evident below 500R, while higher temperature analysis the use of Inconel X, extreme temperatures require L-61.

Core Making—Steel and high-alloy stainless steel usually is manufactured in square, hexagonal, hexagonal, or wobble-free roll types although many other special core designs have been produced experimentally.

The square roll hexagonal core is manufactured in the fully open condition, and it only be collapsed if grinding or machining operations are required. Such straight roll cores are indicated—the core assumes a radial condition when it is bent to angle position, the expanded cores face becoming concave in a direction perpendicular to the bend line.

Another interesting core, suitable for optimum straight through design, is known as the "egg core." The long-angled and tapered sections are each drilled half way, and assembled to fit. This configuration results bending completely along the longitudinal and transverse axis, while intermediate bending between these directions is easily maintained the valves are.

These two types of core are, in general, suitable for standard parts having severe two- or three-dimensional curvature, the valves claim.

Core Applications—A number of outstanding all-purpose hexagonal cores have been developed primarily to accommodate curved subsea applications. A core with extreme compound radiating characteristics, including a highly extendable coil configuration, is known as Weygold (Sklar registered core).

In addition to this core, two other

# Freedom's Team

At outposts of freedom near the Arctic Circle—made possible by our agreements with other governments which stand with us against aggression—U.S. Air Force men are now standing around-the-clock, around-the-planet guard. Backing them up are the resources of American science and industry which have produced the Northrop Scorpion F-89 all-weather interceptor. The F-89 is America's heaviest-armed fighter. Wingtip "barrel" missiles which carry 304 rocket propellant are coupled with the latest electronics to make the F-89 a deadly aerial destroyer, capable of striking a bomber 45,000 feet and more above the earth. These jet home defenses are one of many modern weapons created by the engineering and production resources of Northrop Aircraft, Inc., since 1939 America's first company in the vital design, development and production of all-weather and jet-interceptor.

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## safety protection by A. W. Haydon



"Icing conditions heavy —  
de-icers working fine —  
handles on screen . . ."

Lockheed's F-4C, Boeing, B-54F, All weather interceptors can get "upgraded" as a heavy icing in service icing conditions that could paralyze its operation is removed. Icing may also melt, prevent, avoid, handle, make it possible for the "Dialer" in each the enemy — through an and storm—reference and whenever he only attack need to handle him out of the air.



### A. W. HAYDON COMPANY

7800 series repeat cycle de-icer now  
custom designed for Lockheed's  
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Designed to control the power for 30 de-icing circuits, carrying 2 phase 400 cycle current in the heater in 10 wing sections, providing accurate current transfer from one section to the next in 10 second intervals. Each 30 second heat cycle is held within — 10 second tolerance with an A. W. Haydon Chronometrically Generated 9 C. Timing Base, over a voltage range of 10 to 24 volts DC and a temperature range of —147° F. to +140° F.

The heat switches have a current rating of 35 amps at 250 volts 480 cycle 3 phase A.C.  
1.5 hr. rating — 10,000 cycles  
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losses of life between testing vehicles, greater head and results with attached uniform stress distribution. Also, the area opening each cell can further stiffen or insulate—a significant advantage when relatively thin faces are required, it is pointed out. The heavy alloy adds to the solid legs with consequent sharp improvement in their volume and their properties.

With more basic material, and such strength increase factor, but weight remains, rather at a program, each through its.

► **Integrity, Inspection**—Because high-temperature structural sandwich applications are based on the ability to develop very high strength, almost perfect basic integrity appears mandatory, it is stressed.

The most significant single factor to cause the high strength in the extreme state of ultimate content of composite through the bonding sequence. This must be done simultaneously with achieving the desired structural form, which may require anisotropic reinforcement on both surfaces—a difficult combination, especially when having temperature as in the region of 1,500° F.

Frequently, rivet joints are used to fabricate them as flat panels, but Sellen has embedded, satisfying, perfect standards as flat panels in large as 24-in. in.

While non-destructive testing procedures have not been established for all-metal honeycomb structures, there is good reason to believe that practical solutions to this vital problem are possible, the surface remains.

Because the more extensive of basic alloys in the structure is heat treatment that, melting, expansion flow, and resulting mechanical bonding has occurred both X-ray and more methods hold full promise for determining flat customer in all metal honeycomb structures, it is pointed out.

► **Placed Properties**—The surface of just these characteristics:

• **With high-temperature** heating, strength of all-metal honeycomb steel and stainless steel can be maintained at elevated temperatures.

• **Compressive strength** of the sandwich is greatly dependent upon cell design. Through proper selection of cell configuration and material, values as high as 4,000 psi have been achieved in 2-in. (0.02 in.) thick cell core.

• **Creep properties** of high-temperature honeycomb construction is superior to aluminum based sandwiches at all temperatures. Tests up to 1,500° F. have shown Sellen's honeycomb materials to have no effect creep reaction.

• **Favorable impact strength** of all-metal sandwiches has been indicated by ballistic-drug experiments. On shock-type

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## FASTENER PROBLEM



## Reducing weight and saving time in joining major substructures

Use of a hex shaped or 20 point type nut to join major aircraft substructures and mainplanes (wing, tail, etc.), time-consuming operations. 1) self-aligning locknut prevents the possibility of misalignment. 2) prevents drilling existing bolt holes and an accompanying body percentage of manufacturing expense. A simplification of these joining operations has long been an objective of every major American aircraft manufacturer.

ESMA type 2022 is the simplest and most efficient solution to this problem. First, the shape of the nut fits into a single drilled hole — fits and does not have to be held for wrenching. The locknut fits into the hole and is completely eliminated. In many cases this permits major reductions in the net weight of the fastener or structural members to be joined because extra distance can be reduced.

Second, the nut is self-aligning, preventing the need of the bolt hole, it is designed into the nut. As a result, manufacturing problems are virtually eliminated and production expenses result from working in the normal tolerances required for installation.

Third, a steel clip is placed which wraps on the nut and when the nut is inserted into a drilled hole it breaks and holds the nut in the proper position to remove the bolt.

Fourth, to meet the tensile requirements of these critical applications the nut develops 150,000 psi at the pitch diameter of the bolt.

Fifth, type 2022 is a superior fastener in weight by being an aluminum alloy which is lighter than steel.

Sixth, this type has high tensile flanging barrel end nuts and end plates, locking collars to generate vibration proof, self-locking performance and excellent durability.

Do you have an assembly problem the new type 2022 nut solves? It is available in 1/8, 3/16, 1/2, 3/4, 1, 1 1/2, 2, 3, 4, 5, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, 56, 58, 60, 62, 64, 66, 68, 70, 72, 74, 76, 78, 80, 82, 84, 86, 88, 90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110, 112, 114, 116, 118, 120, 122, 124, 126, 128, 130, 132, 134, 136, 138, 140, 142, 144, 146, 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186, 188, 190, 192, 194, 196, 198, 200, 202, 204, 206, 208, 210, 212, 214, 216, 218, 220, 222, 224, 226, 228, 230, 232, 234, 236, 238, 240, 242, 244, 246, 248, 250, 252, 254, 256, 258, 260, 262, 264, 266, 268, 270, 272, 274, 276, 278, 280, 282, 284, 286, 288, 290, 292, 294, 296, 298, 300, 302, 304, 306, 308, 310, 312, 314, 316, 318, 320, 322, 324, 326, 328, 330, 332, 334, 336, 338, 340, 342, 344, 346, 348, 350, 352, 354, 356, 358, 360, 362, 364, 366, 368, 370, 372, 374, 376, 378, 380, 382, 384, 386, 388, 390, 392, 394, 396, 398, 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for soil temperatures in the range of 1,000 to 1,700°F.

Another variation of soil study probe shows involves the application of super-thin honeycomb with turbine rotor blade tips, to form a self-fitting construction.

•**Shaped sandwich.** Extensive applications requiring engineered cores need both practical core machining methods and sandwich assembly techniques, Long and Connor say.

Representative shaped parts fabricated successfully with high-temperature bearing include a turbine vane and nozzle in sections. These were mechanically reinforced using plastic support methods. Wide application of such constructed sandwich is predicted for such areas as landing edges, fins, control surfaces, slots, and turbine vanes (see also).

Another type of three-dimensional sandwich, with special Weygold core, is a smooth lead cap with an outer skin of 31 in. and a core thickness of 1 in. Both faces and core are 902 in. AISI 321.

Because of the exceptional metallurgical bond strength of high-temperature bonded parts, it has been found feasible to stretch-form bonded sandwich, the authors reveal. Flat sandwich specimens, i.e., flat, with AISI 321 100-in. skins were bent to radius of 3 in. to 7 in. Maximum permanent set for these particular sandwiches was roughly 10%.

Twice stretch-bending has been obtained with elongations of 15% or more, significant improvement in stiffness as compared plastic deformation.

•**Conical structures.** Conical shaped parts are frequently encountered in hydraulic and aircraft construction. Applications where aluminum sandwich may fit while not as difficult, during, fatigue shocks, engine surges, and aircraft crash landings.

Simple, bracketed cone designs are readily removable to honeycomb sandwich fabrication. Double conical, non-symmetrical conical sections are feasible but require careful preparation of sandwich components and rather extensive tooling, it is revealed.

•**Heat panel.** An experimental all-metal sandwich for use as a rocket blast shield has been devised. The panel has a normal structural sandwich base, on which is superimposed a reflective, filled honeycomb core and thin skin. Purpose of the reflective core is to resist extremely high velocity, high heat incident without penetrating the panel.

In a direct rocket blast test, the 1-in. refractory filling of bonded aluminum core showed marginal success in absorbing the tremendous blast pressure and heat. By removal of honeycomb core and substitution of reflective without the blast without cracking at



How the T. J. GOODRICH COMPANY ensures the safety of the Neprane P-37 on Timken bearings to take heavy landing shocks, prevent fire overhauls.

## TIMKEN® bearings take 3-way landing shocks of world's fastest sub-killer

WHEN Lockheed's new Neprane comes in for a landing, its landing wheel bearings have to stand up under 3 way punishment—the radial shock loads caused by the landing impact, the rapid acceleration of the wheels when they touch down and the thrust shock loads resulting from cross winds.

That's why Timken® tapered roller bearings were selected for this new P-37 Neprane.

Because Timken bearings have full line contact between rollers and races, they have load-carrying capacity to spare. And, being case-carburized, their rollers and races have tough, shock-resistant outer hard, wear-resistant surfaces.

Because Timken bearings practically eliminate vibrations, they can easily stand up under the rapid acceleration, from zero to 3 g in. to as much as 500 g p.m., at

landing of the Neprane's wheels. Timken bearings are designed to roll free, by geometrical law. And they are precision manufactured to live up to these designs.

Because Timken bearings are tapered, they easily take the thrust loads of cross-wind landings as well as radial loads.

No other bearings give you all the advantages you get from Timken bearings. To be sure we get the best steel for Timken bearings, we even make our own. No other U. S. bearing company does. Always look for the trademark "Timken" on the bearings when you buy or build equipment. The Timken Roller Bearing Company, Canton, O., Ohio. Canadian plant at Windsor, Ont. Cable address: "Timkenoco".



This mark for a product made in accordance with the law.

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READ ON THE OUTSIDE  
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Rollers and races of Timken bearings are case carburized to give a hard wear resistant surface and a tough, shock absorbing, core. Result: longer bearing life.

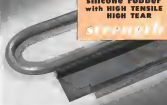
The Timken Company builds all 4 standard types of tapered roller bearings in 14 standard sizes and 4 standard roller diameters.

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**with HIGH TENSILE**  
**STRENGTH**



## Aircraft seals



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Aircraft seals must be capable of meeting sub-zero temperatures and protect high tensile strength, high heat resistance, high stability after long exposure to oxygen, ultraviolet, acid and weather.



**COHRLASTIC HT meets all these requirements with values plus:**

It is easy to use, extruded, reinforced **COHRLASTIC HT** seals can completely replace more easily substituted seals. When necessary — where maximum stability is required — **COHRLASTIC HT** reinforced with fabric and other fabrics is available.

Remember, low compression set, simplicity of installation and low replacement are some of the exclusive characteristics of this important new development. And the applications are many — oxygen ducts, camera doors, hatch door seals, compass scope housings, to name a few. Literature and samples gladly mailed on request.



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applied in selected areas.

Further development of composite sandwich blast panels is planned to ensure complete protection of the structural base materials. Improved thermal shock and stress resistance is anticipated by using a special graphite filling in place of the selectory aluminum.

—James Shaw

## PRODUCTION BRIEFING

▲**Avco Manufacturing Corp.** has established a West Coast division, with headquarters at Los Angeles, for sales and service of the company's defense and industrial products, including electronics, airborne components and propulsion parts of all divisions. Director of the new division is James R. Kim, former USAF colonel and chief of AMEC's legislative liaison division.

▲**Pacific Tube Co.**, Los Angeles, has broken ground for a major expansion of its stainless steel tube producing facilities. The construction, which will double the firm's present capacity, will cost approximately \$200,000.

▲**Ultrasonic vibration** speeds up viable permanent inspection methods. Mobil-Chick Co., Los Angeles 47, reports. High-speed vibration accelerates penetration, water washing to remove excess penetrant dye and development of fine indications. The compact, economical equipment also comes in handy for surface cleaning prior to painting, plating or other processing.

▲**Acropet-General Corp.**, subsidiary of General Tire & Rubber Co., plans to spend several millions of dollars in expanding its plant at Norwalk, near Sacramento, Calif. Several hundred employees will be added in the next year and a half. Present employment is 754.

▲**Flexible Tubing Corp.'s** expanded West Coast operation will be located at 22230 W. Olympic Blvd., Los Angeles. The firm's main office and plant are at Carlsbad, Calif. The new facility occupies about 6,500 sq. ft.

▲**American Machine & Seals Co., Inc.**, Yonkers, N. Y., has been named exclusive distributor for Brown vertical welding heads in all eastern states.

▲**Blind employees** of the Griffin plant of Gramp's Parfumes for the Blind have received more \$60,000 worth of needed security parts in the past 12 months for use in 847 parafumes at Lockhead Aircraft Corp.'s Marietta facility, at a general cost of \$47,000. The items included about 42,000 lb. of wax, bolts, nuts, fittings and other parts.

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## Experts Tackle Traffic Control Problems

• ANDB plans to apply the systems approach to development of navigation devices, conference hears.

By Philip Kline

**Belmont**—The Air Navigation Development Board is sharply reexamining its approach to the development of the Common System of air navigation and traffic control slated for use in the 1965-70 period.

ANDB intends to apply the "systems engineering" approach central to the "patch-quilt" approach of trying to integrate a variety of systems, developed by several independent agencies. The board is already being made up of a group of military and civilian experts to do this various engineering job.

First disclosure of the new ANDB philosophy was made by James I. Asmet, chief of ANDB's newly formed systems engineering group, during a nine-person talk show at the recent East Coast Airborne Electronics Conference.

Other panel members at the symposium on air navigation and traffic control reported on:

- New traffic control display which automatically shows aircraft aircraft position, range, altitude, identification, speed, destination, and estimate time of arrival.
- ANDB helicopter avoided thinking for both tactical and non-tactical service.
- Program and guidelines at ground level used for air traffic control.
- Simulated techniques employed to solve air traffic problems.

### The Systems Approach

The use of systems approach to be used based parameters and to specify in advance the requirements for each subsystem to assure its compatibility has come into widespread use in industry and the military, Asmet pointed out. Aircraft weapons and guided missiles are two examples. Asmet believes that the complexity of the Common System is so great as to demand the same type of systems approach.

In a sense, this new philosophy is actually a return to an old one that dated when ANDB was formed more than five years ago. At that time, ANDB assembled a composite system



**NEW RADAR TRAFFIC DISPLAY**, shows aircock form at electronic meeting, will have low, conventional PFI for showing aircraft altitude and range (arrow) and altitude and position (arrow). Data indicates (arrowed), between the two displays will give flight plan information on the plane under the vertical (arrow) arrow.

engineering staff under Dr. Douglas M. Ewing. But this operating philosophy went by the board less than a year after Korea when the military aviation felt obligated to develop and produce their own individual tactical air and program, and Ewing and his staff left ANDB to return to industry.

• **Patch-Quilt**—Possibilities—Asmet cited several problems of the patch-quilt approach of trying to integrate independent developments into a system for various reasons.

• **Competitive technical solutions** to the same problem are not evaluated, even enough to prevent them from moving into the hardware stage where their individual backers attempt to use prospective users. As examples, Asmet cited the recent DME-Term con-

ference and the split between ILS-GCA and electronic GCA.

• **New equipment** are frequently available to units long before the operational techniques for integrating them into the overall system have been sufficiently developed. An example is surveillance radar which has only recently become a useful tool in air traffic control, despite the fact that the equipment itself is more than 10 years old.

• **Rounding Up Talent**—To handle the ANDB program, Asmet wants a small group of men who have experience in systems engineering on air navigation and traffic control equipment.

ANDB has already held preliminary discussions with the Civil Aeronautics Administration and the three military services to see if it can obtain a few of



*The power and massive power of the Boeing Air Command line gives it a unique role in the arsenal of military hardware. That of a dominant force for world peace. Superior aircraft like these B-57s is available at March Air Force Base, California, expertly trained maintenance and flight crews, advanced weapons and dedicated leaders, make it America's most potent defender.*

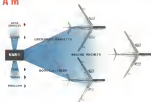
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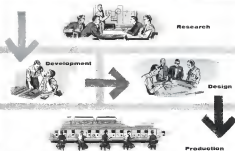
It takes 13,000 horses to speed American Airlines' DC-7s on their coast-to-coast hops across the continent. That's a lot of power to pull one plane—but, then, 365 miles-per-hour is a lot of speed for a commercial airliner. This speed plus the luxury of the DC-7 accounts for the fact that American has had to *angle* its new service in less than six months time.

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their specialists, possibly on a loan basis for a year or two. ANDR has also proposed that each service request the group with consultants who can be made available in thousands to provide immediate effort. Asst. Sec. of the Air Force, W. H. Wiers, said that all four agencies appear anxious to cooperate.

"We expect that the output of the group will be a system characteristic and the detailed technical characteristics of equipment and techniques which will be the nature of the group," Asst. Sec. of the Air Force, W. H. Wiers, said. These characteristics will then form the basis for development, experiments, tests, and evaluation by the various civil and military agencies under ANDR supervision.

► **Systems Lab Needed**—"No system design group can function properly without lab and extensive system flight or presentation facilities," Asst. pointed out. "We believe it is necessary that facilities of this type, both in government and industry, be available to carry out work at the behest of the system design group."

If possible, the entire system to which the various units be put together physically and tested for final proof, Asst. says.

## New Traffic Display

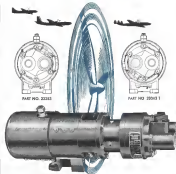
A new type of display which shows aircraft positions in three dimensions, as well as other pertinent information needed for traffic control, was described and demonstrated in a workshop by W. G. Knodel of Bell Telephone Labs. RIT, is developing the new air traffic display under ANDR sponsorship.

► **Twins Replicated**—The display will consist of a transparent PPI type, showing aircraft bearing and distance, plus a second display atop the PPI, showing aircraft altitude and exact component of its altitude movement.

Data reduction aids in this mode by using Smith & Spigot will be associated between the two displays to give the ground controller information on an individual aircraft's destination, estimated time of arrival, electronic speed class and other flight plan data.

This data will be fed by the pilot at the start of a flight, then transmitted by teletype to a large electronic memory device, such as the unit currently undergoing CNA evaluation at its La Jolla radar test center. This device, developed by Engineering Research & Associates, can store up to 3,000 flight plans and produce any one of them at the surface of a second, alpha teleprinter.

► **How Display Will Work**—When a plane enters the radar surveillance area and appears on the PPI, the ground controller establishes its identity and its bearing to provide. Initially this will



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to become voice communications but controls of can be utilized simultaneously in cases of helicopter rescue and other rescue devices.

The controller then produces a vertical cursor (pitch) a 500 yard it is aligned on the particular aircraft's PFI map. The next step is the engine's identification and its horizontal altitude, then dependent on "acoustic" button. This will cause the following to take place:

- New map will appear on the upper scope display under the cursor line at the horizontal altitude level of the plane just acquired.
- Magnetic memory drum will be interrupted automatically for the full flight plan of the aircraft which will be displayed on the data indicators, showing the controller the plane's time of departure, ETA destination, altitude, airport, speed class, and similar relevant data.
- A track-wide-area computer, in radar device, will lock onto the aircraft's radar signal and track it continuously. As the target moves on the PFI, the track wide-area computer will cause the present map on the upper scope to follow its movement so as to always remain exactly above the corresponding map on the PFI.
- Center, track-wide-area computer, magnetic memory drum, and the map on the PFI scope will be synchronized so that whenever the ground controller positions the cursor over this map, he gets on the PFI the flight plan information for that particular aircraft will be extracted from the magnetic drum and automatically displayed on the data indicators.

Whenever the cursor is positioned over the PFI map of any data previously acquired aircraft, the data substation will change to display that aircraft's flight plan data.

Using such data on an automatic altitude operating station as height-finder data costs into time, it will be up to the ground controller to obtain voice reports on changes in altitude altitude, and peak buttons to react these changes into the system and the eye altitude display.

• **Black Wave Receiver:** The new RTL display is in the very early stages of development and it will probably be available two years before an operating prototype is available for evaluation. Avoid field service. While RTL also intends to investigate possible new techniques for the PFI and altitude display. This includes both a projected CRT system and the new dual-line storage-type CRTs.

#### Copter Aids

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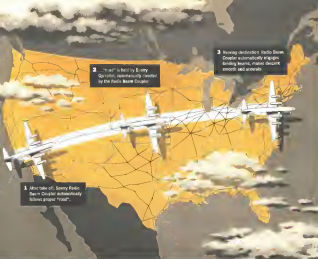
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Before long, you'll read headlines like the one above announcing the completion of one phase of a nationwide federal system of aerial "highways." Already 61,350 miles of these radio routes are in daily use as ready-to-use—and while you'll never see the broad "lanes," "ramps" and accurate "signposts" designed for your protection, they're

just as real as on your favorite turnpike.

• To utilize the full value of these aerial highways, more and more airlines are being equipped with two Sperry developments . . . the A-12 Gyroplane Flight Control and the new Radio Beam Coupler which simplifies these high-frequency radio signals in actual guidance of the plane. It's a combination that can't be equaled. For route, the plane rides smoothly on an accurate course, and

guided by cross winds or drift. In landing, the human pilot has the assistance of a radio electronic pilot that automatically engages the landing and landing beam to bring the plane accurately down to the runway.

• For more than 40 years, military and commercial aviation has depended on Sperry to originate, develop and manufacture the finest in flight instruments and controls. The A-12 Gyroplane and Radio Beam Coupler are typical of many Sperry developments that make modern flight safe, dependable and comfortable.

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helicopter use at the Navy's air test center at Patuxent River, Md. Bush added that evolution of helicopter systems such as Radar and Radio Decca is being considered but not yet programmed.

Recent announcement that Radar Avionics Pacific, Inc., has obtained U. S. rights in Radar Decca system to exploit its helicopter potentialities nullified earlier hopes evolution of this equipment.

• **Ground Nav-Aid Problem**—Based on preliminary evaluation studies, the outlook for ground-based aids is not too favorable, Bush said.

Radar and VOR (line-of-sight) equipment's "most serious immediate engineering problem is give coverage to the ground," Bush said. Furthermore, the multiple conditions required involve costs that appear to be economically unacceptable.

"The low-frequency solution (such as Decca) sounds good until you remember the interference of weather noise," Bush pointed out. The military also runs the question of power requirements, he said.

• **New System Needed**—Present thinking, according to Bush, is that ANDD must soon begin the development of a new cockpit navigation system. Some of the possible approaches include:

• **High-frequency waves**, operating in K band or higher, and in conjunction with corner reflector or radar beacons on the ground. A similar system, reported in *Aircraft World* July 13, 1966, has been proposed by Frank Theault and Ronald Peterson of Panavia Helicopter Corp.

The radar need have a range of only 18 miles, possible less. The advantage of reflective radar, Bush says, is that it avoids expensive ground installations and permits helicopters to make frequent outside stops. Disadvantages are its size, weight and cost.

• **Dual-functioning computer** in combination with device to give positive indication of relative motion over the ground (Doppler radar or acoustical radar) is another possibility. Ground beacons at intervals could be used to assist computer and make out-crews' head work. Advantages and disadvantages of such a device are constantly the same as for reflective radar, Bush said.

• **Combination of VOR**, unattended beacon, beam beacons for location, and high-intensity lights might prove adequate. A helicopter pilot flying at 45 knots or less can complete visual work when a dual-wave pilot flying at 330 knots can not. Both points out.

Bush believes that an automatic pilot is "almost a necessity" for helicopter development, particularly weather flying.

• **NAVBY Radio For Radio-Aid**—Decca radio beacons blanket the country's area

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of interest in traffic, and could be used to improve on route traffic control, where it becomes possible to pipe them, except during to or from traffic control routes. Dr. G. C. Constock told the symposium audience. However he added that the system to be used later on.

Constock, who played a prominent role in developing GCA during the war (and is now in similar work for Airborne Instruments Laboratory) discussed new developments which hold promise of making current route decisions.

One is the use of circular polarization, now being added to GCA, to detect intruders, to reduce the scope "blatant" caused by precipitation.

The other is the use of airborne transponder beacons, and secondary ground radar to interrogate these beacons, which will serve to identify individual aircraft on the FPI, as well as reinforcing the target radar.

Constock suggested that further improvement in target radar and MTI (moving target indicator) performance could be obtained if the present systems scan rate were reduced from 25 rpm to approximately 12 rpm. One drawback to that higher scan rate, a carry-over from military GCA, was selected during the war largely on the basis of expediency and availability of drive motors.

► **Benefits From Simulation**—A dynamic simulation located at CAN's Technical Development Evaluation Center in Indianapolis has proven extremely valuable in developing traffic control techniques suitable for use with ground radar. See Airnews of the Franklin Institute reported. Franklin Institute, under ANR's sponsorship, is responsible for developing air traffic control simulation techniques and equipment.

The simulation is also useful in evaluating new traffic data displays, and in working out optimum procedures for clearance to conflict, altitude, descent, and course crossing.

Col. J. Francis Taylor, chairman of ANR, noted its great thickness and modesty.

### Electro-Scan Handles Operations From Afar

Bendix-Pacific has developed a new digital type remote-control system which can be used to transmit technological data from sophisticated weather stations, handle space communications, directed air or missile reconnaissance computer such as American Airlines' Reservoir, or operation in sophisticated radar.

The new system, called Electro-Scan, can transmit data and perform control functions over regular telephone/teletype lines, radio or microwave links,



### UNDER ONE ROOF

By James J. Haggerty, Jr.  
(No. 7 in a series)

### "Beneath 40 miles of catwalks enthusiastic Georgians build big jet-powered bombers and transports"

By James J. Haggerty, Jr., Aviation Staff Writer, Oilman's



Without retreating a step, you can talk for 40 miles on the catwalks in GA-6 (Government Aircraft Plant No. 40) in Marietta, Georgia. This is just another indication of the immense size of this aircraft plant, largest under one roof in the world.

Size of facility is the manufacturer of big multi-engine airplanes means many things. One of the most important is the effect on people. The Lockheed employees at GA-6 have never passed a production schedule. In fact, they are producing six-engine B-47 jet bombers today with 75% less

man hours than required two years ago. They have room to move around, room to do their best work, room to see the latest stages of manufacture and assembly, room to keep an orderly system of production flowing.

Right now, Lockheed Georgians are building new B-47s, modifying earlier models, and manufacturing new C-130A turbo-prop powered transports. And because GA-6 is so big—70 acres of floor space under one roof in Building B-1—there is still room to build more big airplanes for the U.S. Air Force

### U.S. Air Force

Best Aircraft Plant No. 2

### Lockheed

Aircraft Corporation  
(a Lockheed company)

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Review of aluminum coil designs of the oil-cool type (left) and the air-cool type (right) employ oil-cooled condenser for maximum strength against corrosion.

Optical columns to temperature, pressure, vibration and wear.

## Progress In Oil Coolers . . .

Based on unique, proprietary processes for producing and testing thin metal sections, the Clifford Company has pioneered the major developments in this field since 1940.

An aircraft condenser becomes increasingly severe with the drive for higher speeds, even greater altitude, longer intercepting operations of engine instruments all become a critical, complex burden. Order is essential to survival.

Oil cooling is pre-war performance engine, but today becomes complex heat exchanger problem further complicated by the need to provide adequate heat rejection capacity within strict limits of size, weight—and sometimes even shape.

These unique aircraft coil designs to bear an aircraft heat exchanger problems have been totally impossible for the fact that it has indicated the major advances in the oil-cool field since 1940.

One asset in Clifford's ability to produce and fabricate thin metal sections, based on its own developments in deep drawing and extrusion.

Another is its exclusive proprietary process for testing thin metal—particularly aluminum—which is unmatched by any other process.

Third is Clifford's wind tunnel laboratory—the largest, most completely equipped industrial facility of its kind. Clifford's background since the very beginning in 1920 was in the manufacture of thin metal sections, coils and heat exchangers.



Producers use special extrusion of aluminum heat exchanger coils.



Exhaustion of aluminum is typical of oil-cool type of Clifford design for maximum compression efficiency, maximum pressure and other factors.

Typically, it looks into this field by developing the new, superior hydraulic former method of producing coils which today is the standard process throughout the world.

Handling the metal sections to produce products for the control of heat, pressure, vibration, heat exchangers in such as Clifford's entry into the aircraft field.

The deep drawing and extrusion process eliminated the elimination of the wind tunnels in the pre-war preparation days and Clifford was asked to produce proper tests for the maintenance of aircraft oil coolers and condenser sections.

Over repeated with the field, it was not long before Clifford's metallurgical background governed an area of opportunity. Copper coils were not widely satisfactory. The big difference, instead of turning the tubes to standard metal that alloy steels were experienced at pressures of only 100 psi. With oil pressure testing steadily opened in the same process, the situation was right for the introduction of a better design it also could be found.

Five years of metallurgical research at Clifford had resulted in a unique, proprietary process for testing thin metal sections. Combining its earlier development in deep drawing and extrusion of thin metal, Clifford independently designed and produced the first aluminum oil cooler and condenser radiator.

The new unit weighed only one-third as much as conventional copper coolers and life cycle tests showed a far superior service experience. The air services gave their enthusiastic approval and Clifford found itself in the forefront of a new field.

First to the new aluminum oil coolers and condenser radiators were the Air Force F-8 and F-84, then quickly followed. At the very end, Clifford was the sole producer of aluminum oil coolers, whose products had been market tested.



Lockheed's chosen F-78 was among the first military aircraft in air Clifford's newly developed oil-cooled oil coolers and condenser radiators.



Condenser radiators of the type used in modern liquid cooled turbojet engines.

Early jet engines coming along after the war required an oil cooling device. Oil was simply pumped on the bearings and spun control overboard. But with general aircraft's contract to produce the J47, Clifford was asked to design a suitable cooling system.

A completely new concept of oil cooling was suggested by Clifford. These jets required large amounts of fuel it was possible to pass cold fuel on one side of the heat exchanger, hot fuel, heat on the other. With the flow governed by thermodynamic valves, the lubricating oil is kept at uniform temperature.

The new design, since it did not depend on flow for cooling, could be mounted out of the air stream and more easily removed. These and other advantages caused it to be adopted as standard for military jet aircraft.

Later experiments resulted in substantial weight reduction and the elimination of numerous parts. Relying on an extruded aluminum shell fastened by its proprietary latching process, Clifford is today the only company able to produce these superior aluminum, all-aluminum oil coolers.

Clifford's wind tunnel laboratory plays an increasingly important role in keeping the company in the forefront of aircraft heat exchanger developments. Ability to simulate certain conditions with great accuracy simulates the need for more complete, expressive field testing of new designs. Its most source of improved knowledge is the rapid translation of theory into practice. Theoretical line drawings without need for a succession of pilot models.

In the comparison of these such a direct line simulation between research and production can be found at Clifford.

New developments, still under military or preliminary stage include a new oil cooler design brief on more recent test of oil-cooled engines. The oil and its pressure part of the fuel before it enters the combustion chamber.



Lockheed's chosen F-78 was among the first military aircraft in air Clifford's newly developed oil-cooled oil coolers and condenser radiators.



Advanced, simplified design of liquid-type radiator for jet engines (left) shows aluminum-cooled oil-cooled radiator (right) shown by Clifford, Ontario.

Both end view of aluminum, weight reduced 25%, and a design, which oil-cooled radiator showed.



A great reduction in weight and bulk is achieved.

Another involves a special oil meter for afterburning which automatically cuts in and out with the operation of the afterburner.

Several oil cooling systems for jet engines are of "high altitude" conditions. When fuel flow drops too low to provide adequate cooling, thermodynamic valves shut in an auxiliary oil-type radiator.

Although some especially difficult problems, Clifford is directed from the front in various fields—as is however—makes that oil cooler demands highly variable, Clifford is currently developing two answers to these problems. One is an air-type radiator in an auxiliary radiator which is used to reduce a flow of air for cooling. The second employs an air-type radiator placed in the air stream, but having its internal flow driven by a fuel pump. Oil temperature determines the operation of the fan, through the action of thermodynamic valves.

Another, similar to which engine application are often made in which engine is working. The company is also developing a new oil cooler design which is the handling of engine problems. In all these cases, Clifford's unexcelled training in strength and endurance, and its unique ability to produce, fabricate and test thin metal sections by proprietary processes is largely responsible for its present lead, which is a significant engineering design.

For further information write: Clifford Manufacturing Company, 775 South St., South 15, State Division of General Motors Corporation, Office in New York, Detroit, Chicago, Los Angeles and Wichita, Mass.

Wind tunnel test of oil-cool type heat exchanger (left) shows the oil-cooled radiator (right) shown by Clifford, Ontario.



Lockheed's chosen F-78 was among the first military aircraft in air Clifford's newly developed oil-cooled oil coolers and condenser radiators.



Lockheed's chosen F-78 was among the first military aircraft in air Clifford's newly developed oil-cooled oil coolers and condenser radiators.



## PRIME WEAPON IN EUROPEAN DEFENCE AGAINST ATOMIC ATTACK



If - and where - Germany overruns Western Europe, opening routes will probably be a severe attack at night in fearful weather. The payload of atomic hydrogen bombs can be delivered with the minimum of air power. No more one thousand bomber raids. It will be a rapid attack and a blitzkrieg, before the specifications for the six-toned Gloster Javelin, Western Europe's primary defence in the air against atomic attack. There are a number of night fighters, but none of them has the defensive strength of the Javelin. It is a big aircraft and a powerful one, equipped with two Supersonic and a two-man crew, a pilot and a radar crew, because we at Western Europe believe the radar job is equally important to the Spring of the extremely complicated instrument.



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When radar signals that the enemy is en route across the Atlantic, the Javelin can be in combat height, fully loaded, ready to fight in any weather, day or night, in a matter of minutes - and it can be refuelled and re-armed in minutes. No other all-weather fighter exists anywhere in this range, speed, fire power or radar. No wonder then that when you see the Javelin is the most important aircraft in Europe. It is now in super priority production for the Royal Air Force, by Gloster, makers of the world's first successful jet aircraft, and maker of the remarkable Hawker Siddeley Gyron.

DAY AND NIGHT ALL WEATHER FIGHTER  
**Gloster Javelin**

Additional details may be obtained from Dept. 531, Pacific Division, Boeing Aircraft Corp., 1600 Stearns Way, North Hollywood, Calif.



FEAR OF ELECTRO-SCAN control panel

with the high accuracy inherent in digital systems.

► **Aviation Uses—**Electro-Scan is currently making an Electro-Scan system for transmitting meteorological data from a number of remote weather stations for an unidentified customer, probably military. The new system is said to be well suited for being in with large magnetic memory drums such as the one CAA is now installing, at a score of storing meteorological and aircraft flight plan information in digital form.

Electro-Scan also could be used to turn on and off a variety of field lights and landing aids at a single auxiliary landing field, employing only a single pair of telephone wires, as a radio link to the auxiliary field.

Electro-Scan also can be used to manual calculations performed on punch cards in a number of machines for operating punch-card machines. The new system was originally developed for a classified military project.

► **Two Types—**The new digital control system is available in two basic types, each of which can be tailored to a specific job.

► **Frequency-coded, transmitting data by means of a group of sinusoidal tones selected according to the binary numbers being transmitted.** The system can handle 200 "bits" per second, requires a 2,000-cps bandwidth.

► **Pulse-coded, transmitted sequentially, is able to handle 10 bits/sec., and requires a bandwidth of only 30 cps.**

"Through the use of multiple, truly unique, the company says that virtually any number of teleprinter and control functions can be accommodated."

► **Accuracy—**System accuracy (or error rate, resolution) depends upon the length of the binary number system used. A ten-digit number system provides resolution to within 1.5%, a 10-digit system to within 0.1%. A nine-digit system, however, adds a word which limits coding errors to plus or minus one number position.

Additional details may be obtained from Dept. 531, Pacific Division, Boeing Aircraft Corp., 1600 Stearns Way, North Hollywood, Calif.

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Increased production of Mycalex 410 Televiewing Comutators now brings new savings to the user. Universally accepted as the lowest commutator plate in the field, this prime-of-built unit, with its standard of Mycalex 410 glass-banded fiber insulation ensures permanent, measured stability—provides a tremendous boost to the world's most

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# Happy



## WOODBEAMS #1

Mary Lockler is happy — and we're ALL happy — when the major wife Southwest Airman was privileged to play in planning and staging the National Business Aircraft Association's special 1954 convention. With others from throughout the land, we had a hand in shaping not another history in keeping with a 25 year-old SAC tradition of supporting worthy industry projects. Keep your eyes on MBAA. If, meanwhile, they stray to our Mary, she's 25, 118 lbs., 5'7", with green eyes, brown hair. And, my dear — **HAPPY CHRISTMAS and so!**

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BALTIMORE

Interesting highlights from some of the papers presented here during the recent East Coast Conference on Airborne and Naughtman Electronics include:

► **Sharp-Eyed Tone Radar**—Better recognition of ground targets is expected from a new airport surface detection equipment (ASDE) under development by Airborne Instruments Lab as a result of larger antennas which will reduce crosswind beamwidth. New ASDE beamwidth will be 0.35 deg vs. 1-1.4 deg for the earlier and demonstrated at N.Y. International Airport (AVIATION WEEK Sept. 29, 1951, p. 37).

New tone radar, being developed under ASDE sponsorship, will have a (244) surface resolution is a split second an elevated radome to minimize windload effects. B. E. Woodward of AIL reported AIL is the exploring ways of resolving the top-earlier display using a radio link, Woodward said.

► **ARC-21 Looking Better** — RCA's such unified ARC-21 high-frequency transmitter whose early availability prompted a congressional investigation (AVIATION WEEK Aug. 9, p. 29) has had a "forty-fold increase in reliability in the past six months." George H. Selzer, chief of the communications branch, WAJEC, told the Baltimore Journal conference here. One reason for the improvement, according to Selzer, is improved quality control measures including a 40-hour factory run-in with vibration during 10 minutes of each hour. Some observers predict that F-46s Flying Ground's report on its recent ARC-21 tests will be extremely favorable.

► **Stable Table Tip**—Integrating gyro as a spatial reference for stabilized platforms are superior to site gyro employing an external integrating means, giving an order of magnitude greater stability, H. R. Whitson of the Massachusetts Institute of Technology reported.

► **New UHF Direction Finder**—A novel broadband, nonresonant, directional antenna developed by Airborne Instruments Lab is credited with making possible a successful airborne UHF direction finder, the AN/ARX-35, in solving the problem of multiple reflections from the surface in the frequency band, according to Peter D. Stone of AIL. Developed for

## FURY ON THE TRAIL

Pursuitably, as it is a rendezvous with doom—as indeed it is—the guided missile blasts its way through the long reaches of the sky. The roaring flame is its power, but the "eyes" and "brain" that guide and control it are electronics.

RCA has cooperated for years with the armed forces to develop guided missiles of ever-increasing accuracy and effectiveness. The same mutual effort that is constantly being applied to creating, designing, developing and producing complete electronic systems in this and other fields relating to national defense.

Engineering consultation available

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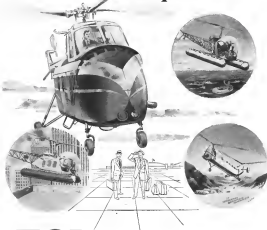
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Navy blades, the ARA-25 is being produced by Collins Radio and operates in conjunction with the ARA-17 UHF transmitter. Brown reported that ARA-25 bearing error approaches zero when plane is banked toward station, but may run as high as 30 degrees when the station direction is head-on.

★**Rapier on Navaho "DIME"**—A station report on the development of a very high accuracy "DIME" standard, required for the distance measuring portion of the new Navaho long-distance missile, was presented to the Ballistic missile conference by C. R. Hewitt, Wright Air Development Center. A test developed by Bell Labs weighing 50 lb., measuring 2 in. ft., and which can transmit its frequency to within one part in one billion for 24 hours, is under test by Naval Air Force of San Diego's Boulder (Coke) lab, Hewitt said. Developments now under way are aimed at cutting size and weight to 4 oz. ft., and 25 lb., and extending operating stability to 1 hour, which represents a major repeat flight time, Hewitt reported. —PK

## New Equipment For Servo Systems

A new servo-amplifier for operating two-phase, 400-cycle servo motors, weighs only 5.5 oz. It is an off set and acutely reversible device suitable for use in servo mechanisms.

The new type VA-4-A-50 amplifier uses vacuum tubes. It delivers 4 watts into the control phase of an a.c. motor, when driven by a 20-volt input signal. The unit is encapsulated in epoxy resin and designed for continuous operation at 40C. Dimensions are 4 x 2 1/2 x 1 1/2 in. Manufacturer: Clifton Precision, Fresh Meadows Co., Mineola at Roseton, Clifton Heights, Pa.

Other new servo components include: ★**Subminiature d.c. motor** with planetary gear reduction, measuring only 3 in. in diameter and weighing in less than 5 gm., is available in 19 different sizes and gear reduction ratios. Motor length varies between 2 1/2 and 3 1/2 in., depending on ratio. Motor is a permanent magnet type. Manufacturer: Globe Industries, Inc., 1754 Stanley Ave., Dayton. ★**Microdrive amplifier**, with fractional watt input and 100-watt output, will accept a.c., d.c., and phase shift, current signals as low as 50 mV and provide power gain of 300 to 1,000. Unit weighs 4 lb., occupies 12 cu. in., can be operated at supply frequency of 100-600 cps., and reportedly operates over temperature range of -50F to +100F. Manufacturer: Standard Plastic and Electronics Co., 1540 S. Robertson Blvd., Los Angeles 35, Calif.

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**NEWEST TRANSPORT CONCEPT** is Lockheed's C-130A cargo plane, shown here in its dramatic low light. Now in production at Greenville Airfield, Plant No. 8, owned by Lockheed's Georgia Division.



Meanwhile, the giant plane literally jumped off the runway as one-third the distance required for today's commercial transports. The new cargo plane encompasses areas of new designs for better handling of troops, material and equipment.



**BIGGER RADOMES FOR MORE PROTECTION** The radar Super Convolutions makes place in an extremely vital role for U.S. protection. It can warn the nation hours earlier of enemy attack, because it has long range, high speed, plus an tone of electronic intelligence packed in radome as big as some many people (like the bottom one pictured above).

**WORLD'S FASTEST PROPELLER-DRIVEN AIRPLANE** A turbo-propeller Super Conversion for the UK Navy (shown below) Now flying, it will be capable of speeds 200 mph faster than any propeller aircraft now in service. Powered by Pratt & Whitney T40 turbo-propeller engines, this plane promises new speed, new performance and greater economy tomorrow.



## 6 New Lockheeds for U.S. Protection

*Powerful Team Includes Truly Amazing Jet Fighter, High-Speed Assault Transport and Vital Picket Plane*

2004 has been a pretty year for Lockheed, as research, development and production. Six new aircraft in one year include: world's fastest propeller-driven transport, world's first hydrogen-fueled aircraft, latest version of the Navy's Neptune anti-submarine patrol aircraft, a new advanced jet trainer for the Navy, and a truly amazing jet fighter, the F-35A new production, which is not secret to photograph or describe.

On these pages are shown all new models except the discontinued N-384. Also photographed is the vinyl layer Co-molded on flat plates, with decorative top and bottom surfaces. The laminar solution, for example, comes in between 10,000 and 80-800 pounds of dry polymer, yet is held in a very thin plate only 20 mils or less thick due to the unique Loddon design.

**FLIES STRAIGHT UP, LANDS STRAIGHT DOWN** The new Lockheed XPV-3 Vynel-Aerobus, a revolutionary new concept of aircraft developed in cooperation with the U.S. Navy. Now, every step can have its own purpose: lighter materials, every back seat could become a landing field of wheels.



**NEW NAVY ADVANCED JET TRAINER** Often called the world's silver jet airplane, Lockheed's new T-45 advanced trainer for the U.S. Navy is a luxury new safety and performance trainer that can be used for carrier landing and takeoff and can deliver weapons down fields for propeller attacks. By training future jet pilots quickly, the trainer boosts Navy's ability to protect America. Another member of the new Navy-GenCorp defense team.

## ADVANCED GUIDED MISSILE SYSTEMS DEVELOPMENT

Elemental chemistry, nuclear physics, and engineering have joined forces at Los Alamos to form the Molecular Sciences Division in Los Alamos, California. Their mission is to solve the scientific problems defense prohibits, to give our armed forces locally available means of delivering our defensive and military weapons to their targets. To accomplish this vital task, Los Alamos has appropriated \$10-200,000 for a program of laboratory research and development.

## Lockheed

[illegible]

California: Sacramento-San Joaquin; California  
Georgia: Oconee; Georgia: Georgia  
Mississippi: Mississippi; Mississippi: Mississippi  
Louisiana: Atchafalaya; Louisiana: Atchafalaya  
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**HEWEET ELM HUNTER** is the Mary's least version of the Lockwood PIN Mystery Panel member: a rugged, redneckish flyng around with many were student. In primary job, paddling around water with many other members. More new or curious for added interest, power.

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## EQUIPMENT



**AVIATION EXPERIENCE** with hydraulic systems, plus a lot of delicate ground rules, guided Boeing engineers in design of 707's equipment.

## Boeing Reveals 707's Hydraulic Details

Detroit—Boeing Airplane Co. recently gave the aviation industry its first detailed look at the design, operation and features of the hydraulic system of its sweeping design transport, the 707.

The look came during the 1964 Transport Aircraft Hydraulic Conference, sponsored by Nielsen, Inc., here under the name: "It was provided by Boeing engineers Ed Pollock and Al Berner, co-authors of a paper on the 707's hydraulic system. Pollock delivered the paper and added some over-the-air words of his own.

• **No Magic**—There is no magic associated with the design of a hydraulic system, he explained at transport air meet here in for investment and growth, the authors state. As with any system, for any plane, the hydraulic system is a matter of compromise.

These are the general rules Boeing engineers laid down for themselves to follow:

- **Make it simple.**
- **Design so smoothly and adjustment of components is apparent.**
- **Watch the details.** They can make or break the system.
- **Plan the controls so that emergency valves will not affect safety of the aircraft.**
- **Make it accessible for maintenance.**
- **Mechanisms don't generally have multiple diagnosis.**
- **Safety first.**

In Boeing's engineering department these rules were coupled with the results of engineering survey crews who had toured typical maintenance bases to find

out from the airman "what not to do." "It is more important you can say that the hydraulic system of the 707 was designed in reverse," Pollock said.

In addition to the findings of these engineering teams, Boeing made careful studies of BADA (Handbook of Instructions for Aircraft Designers), CAR (Civil Air Regulations) and MIL (Military) specifications to analyze the reasons behind these rules and suggestions and call from them all possible helpful material. So the final design of the 707's hydraulic system is based on a broad foundation of facts reflecting the best and most up-to-date thinking in aircraft hydraulic system design.

• **New Concepts**—A fundamental change in system operation concept is apparent on the 707 when compared to its conventional piston engine predecessor, the 737 Stratoliner.

On the latter aircraft, all major system functions, such as wing flap, aileron flap and landing gear operation, were electrically powered. The 707's hydraulic system supplied power only for such functions as windshield wipers, nose gear steering, brakes and rudder boost. By contrast, on the 707 all of the following services are hydraulically operated: landing system, landing gear operation, nose gear steering, wing flap and wing spoiler operation.

• **Dual Systems**—Two completely independent but separate hydraulic systems, labeled "left" and "right" (because of their respective position on the airplane) have been designed into the 707 for safety considerations. Each has its independent power and distribution systems

For emergency operation, a cross-over valve is installed to allow either the left or right system to supply power for wing flap and landing gear operation.

Additional sources of emergency power are electrically driven hydraulic pumps, one for each system. The pumps, each of which has its independent reservoir, are operated from the plane's battery by three-position switches labeled "emergency," "detention light," and "automatic."

First position is a retraction position and will supply pressure to a separate brake accumulator either in flight or on the ground. The automatic position allows the pumps to be used for ground check-out before engine starting or the emergency power in flight.

• **Five Priorities**—Here is a list of priorities taken by Boeing engineers to reduce the hazard of a hydraulic line to its absolute minimum:

- **No hydraulic lines** have been installed in the pressurized cabin and no lines have been located where they cannot be repaired.
- **Major portion of the hydraulic systems are exposed along the wing's rear spar and in the wheel wells.**
- **Fire valves** are installed in every section line.
- **Hydraulic accessories** are installed in the wing tip.
- **Extensive drain and dump** have been included in duct design combined.
- **Electrical equipment** is all explosion-proof and all electrical connections have been sealed.
- **Power System—Flashes** into these are



## Micro-Wave Specialists

The growing importance of micro-wave applications to aircraft has created a unit opening for a Micro-Wave Specialist at Lockheed Aircraft Corporation.

The position requires a specialist who weighs at least three years' practical experience in all forms radio applications with a strong theoretical background. An advanced degree in Physics is preferred.

Duties will involve keeping abreast of latest developments in the field of microwaves, conducting micro-wave systems for application on Lockheed Aircraft, and acting in a dual advisory capacity on micro-wave subjects.

Lockheed offers you a high salary commensurate with the importance of this position, premium travel and moving allowances, opportunity to enjoy Southern California life, and an extremely wide range of employee benefits which add approximately 14% to each of your salary at the time of retirement, retirement pension, sick leave with pay, etc.

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### Lockheed

Aircraft Corporation  
Burbank, California

tion of "pig drilled" locations whenever possible.

- All valves should be controlled in every position through positive, mechanical linkage. Spring return in sequence valves should not be tolerated.
- Directional valves should be designed so that failure of the control will not be affected if system is not bled.
- Microneg-type valves should be used throughout the system to avoid leaks.
- All cable-controlled valves should be allowed sufficient deflection to make routing easy.
- All cable-controlled valves should be designed to withstand normal handling without loading.
- Hydraulic cylinders should not incorporate stops. Accuracy of end positions must be provided through detaching linkages.

• Substaging of fast-acting devices (such as wing spoilers) should be provided to prevent fatigue failure.

• Independence of hydraulic systems from other systems must be insured to obtain maximum reliability.

► **Spoiler System**—The 707 is equipped with a differential wing spoiler system to increase lateral control. (The 707's rate of roll equals that of the F56 Sabre jet, according to Pilobolus.) The main spoiler may be operated automatically in or back to control angle of approach, for emergency descent or for banking on the ground.

Spoiler system makes up its work wing four actuating cylinders, a cushioning valve, follow-up check valves, follow-up linkage and an electrically operated shutoff valve.

For lateral control, spoiler valve is operated by shutoff control cables. For symmetrical air brake control, a lever actuated by the throttle operates the same greater valve through a control cable linkage. Spoiler control lever is placed next to throttle (which is always in pilot's hands on takeoff) to make it easily accessible to the pilot in case of an aborted takeoff, when the spoiler would be used to kill wing lift, then pulling full weight of the plane in its wheels to allow maximum braking effectiveness. Spoiler operates very quickly—1/2 sec. to open, 1/8 sec. to close.

Following is obtained from only one set of spools. Remaining spools in rear then position according to air loads. Check valves allow spools to blow down instantaneously if design speed is exceeded.

► **Flap System**—The wing flap system is of straight-through design and is made up of two completely independent hydraulic motor drive torque tube control systems. The outboard flaps are interconnected by torque tubes driving bell levers across in the flaps and are driven by a hydraulic motor. Inboard flaps operate the same way.

Two metering valves, incorporating a

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- 3 It releases vehicle operators from any attention to instrumentation.
- 4 It provides an important safety factor by warning of the approach of dangerous conditions.
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- 6 It can save you money in test operating costs and equipment stored costs.

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2. Descalinging aluminum prior to oil painting	Dial®	Acidic temperature dry cleaning solution can test maintenance of aluminum alloys
3. Anodizing cleaning	WLA-6®	Heavy duty work cleaner for anodizing, stain, oxide and loose
4. Removing lead lead acids from aluminum parts, lightening lead treated aluminum	NP Acid	Expensive dangerous hydrofluoric acid water and water to handle and use less sensitive
5. Field finish cleaning	Hobol®	Freon-free wetting. Can labor with, dry clean, finish, polish, bleed or strip an
6. Waterwash paint-bond compound	Flato	Strip paint, remove impurities, little discoloration, finish, dry clean, polish
7. Rechromizing	P.A.-6	Heavy duty electrolytic for cleaning steel before plating. Rechromizing, dechromizing
8. Stral cleaning	Stralac	Add to water to form solution for lighter metal finishes. Remove light finish
9. Rust inhibitors (post dip)	Zinckol	As an all purpose rust inhibitor, makes from industrial scale at lowest cost

### MODIFICATION AND MAINTENANCE

10. Brass cleaning	Alkox	Can clean brass and various alloys of all types of all brass, aluminum, steel, steel, copper
11. Brass cleaning	1-2384®	Alkox (SAE Specification 2384) & Alkox-2122 (SAE) Will not stain steel
12. Corrosion cleaning	P-1019	Noncorrosive, nonfluorinated, nonacidic, nonaqueous for gas and aluminum parts
13. Jetting lead lead cleaning	SWW	A "universal" treatment for removing all types of leading, corrosion, nonfluorinated
14. Removing exhaust valves	1-20	Removes exhaust valves, valves, prevents corrosion in exhaust-chamber areas
15. Washing aircraft surfaces	Alkoxwash 10720	An excellent solution cleaner for regular aircraft maintenance
16. Acid cleaning	Epoxane	Alkox acid remover. Meets Specification AF4349 C
17. Engine test cell cleaning	Alkox®	An all-purpose cleaner for removing dirt, oil and grease from engine test cells
18. Washing engine cleaning	SWW	A special low foaming, non-etching aluminum cleaner. Meets Specification MIL-C-1541
19. Aluminum lightening	Alkox®	Lightens for exterior aircraft surfaces. Cleans and brightens in a single operation

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City \_\_\_\_\_

State \_\_\_\_\_

Following linkage, control the motor. The valves are cable-actuated from a single positioning lever in the cockpit.

Although mechanical down stops have been provided, both on the valves and on the flap tracks, they are not intended for manual use since the full-loop mechanism provides installed hydraulic stops at all positions.

► Main Control: In position, lever in the cockpit controls the main landing gear through a valve located in the main gear well. Linkage between lever and valve is cable. Governor (control) has been allowed to avoid necessity for zero rate lagging.

Landing gear and doors are operated by separate cylinders with positive mechanical sequencing in all positions. Doors are closed after even landing gear extension or retraction.

Another set of automatic sequencing controls apply wheel brakes as soon as gear starts retracting and releases brakes after landing gear is locked in the up position. This stops wheels quickly after takeoff to ensure that the large main gear will be properly positioned for storage in the gear wells. Brakes are then released to keep unnecessary hydraulic pressure from the brake pistons during flight.

Since the landing gear is used as an air brake during takeoffs from high altitudes, Boeing engineers said extreme care in designing for high-temperature changes which such operation would normally encounter.

The main gear door locks in half into the cylinder. There are three lines which go to the cylinder up line, down line and balance line, which purpose is to ensure that any steps in the return line lead to lock, not unlock the gear.

A mechanical extension and down lock mechanism is included in case of complete hydraulic system failure.

Other points about the landing gear: Retraction while the airplane is on the ground is virtually impossible. The main gear will not retract while aircraft weight is on it, even if the landing gear control handle is placed in the up position, because retraction is released (and released) and pressure exerted by the hydraulic system is restricted to bleed the lines on the way. The nose gear has an integrally built downlock openable from the cockpit.

Another feature of the cockpit-controlled nose gear downlock is that it is responsible with the NV, to have non-retractable landing gear when airborne. The nose gear can be unlocked while in flight and the main gear do not have any downlocks.

Also, wing flap and landing gear handles are widely separated in the cockpit to make inadvertent confusion of the two controls impossible.

► Brake System—Brakes are operated conventionally from the pilot's and co-



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FAA TECHNICIANS install new GE CH13 turbo-propeller engine in Stinsonair.

new turbo in its airstrip New York-Penn and New York-Landing flights scheduled to begin Dec. 15 (Aeronautics Week Sept. 26, p. 20). The installation is expected to increase the plane's range by 60-100 mi. under normal operating conditions.

Replacement of the Stinsonair's present turbine with the new model is part of a \$1.3-million three-phase modernization program by the airline in cooperation with Boeing Aircraft Co. and General Electric. It also involves increasing the fuel capacity. The new Super Stinsonair will carry an additional 410 gal., bringing total fuelage to 8,250 gal. and extending range by 200 mi.

The new CH13 turbo-propeller, produced by GE's Aircraft Engines Turbine Dept., Lynn, Mass., runs the turbine end of a modern turbo such as that in the Boeing B-10 turbo-engine bomber and the companion end of the standard Stinsonair turbo. With its large displacement, new coolant gases pass through with less restriction, reducing back pressure on the engine cylinder heads and lowering temperatures.

Cooler engine temperatures permit fuel to be closed in extra rich, decreasing drag enough to give the 50-100 mi. range increase. A revised engine operating technique involves a higher cruise setting and lower propeller speed, which should increase the plane's speed.

The CH13 turbo weighs 290 lb. Up to 25,000 ft., it delivers an output of 225 hp./min. with a discharge pressure of 27.5 in. of mercury absolute.

### OFF THE LINE

Northeast Airlines reports Cessna 441Q (see p. 10) is the DC-9 in redneck breaking hole, prolongs brake life, waterproofs wings, eliminates brake squeal and improves general performance.

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also. Cop-Sil-Lay is an alloy of powdered copper and lead suspended in a bonding fluid which allows it to be hand-applied on basic bronze. The product is manufactured by Cop-Sil-Lay, Inc., El Monte, Calif.

**Turbochargers vs. Turbo Componds.** Production version of Allison's T56 turbo-prop engine will develop some 3,750 shaft horsepower, the same power as Wright Aeronautical's Turbo Compond R3350E61. Allison says that the T56 weighs one ton less and offers a thrust area of only a third that of Turbo Compond.

Capital Airlines' Viscounts will be equipped with Eclipsa Engine T2-11A, automatic pilots and flight jacks, company, says Bendix International.

#### NEW AVIATION PRODUCTS



HYDRO-PAK is used in underwater sleep.

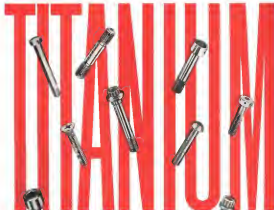
#### Emergency Breathing Unit Useful in Fires, Accidents

A self-contained breathing unit for use in firefighting, underwater activity and suspension or, in case of accidents, for the underwater recovery of bodies and equipment is being offered by Scott Aviation Corp.

Scott's Hydro-Pak has a full-face mask with a large, safety glass "pressure window" providing a wide degree of clear vision underwater. Adjustable air regulators on both sides of the mask permit easy breathing in any position, the maker notes. They are basically the same as the demand regulator used by the first on its weight equipment for aviation, fire services and other industrial equipment.

An Air Escape-mast mounts the compressed air supply under the large bottle strapped on the wearer's back. A float, tough breathing hose is placed out of the way for maximum swimming. Other features of the Hydro-Pak full back plate, air reserve mechanism and water ejection button.

The company maintains a coast-to-coast distribution network for sales



## FASTENINGS mean greater pay loads

Stress titanium came out of the laboratory into production, aircraft manufacturers have learned the amazing savings in weight that this metal can achieve—weight that may be substituted into fuel for longer range or greater lifting capacity for personnel or cargo.

Today Harper offers manufacturers the skill, experience and facilities to fabricate all types of aircraft fastenings from titanium. If you are now using, or are considering using, titanium parts that require cold heading, roll threading, hot forging or milling, you will be interested in Harper's years of experience and the ability to solve any fastening problem.

Mail the coupon for information on fastenings of titanium or other high-temperature or corrosion-resistant metals.

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In Reg. Aerodynamics Division here, discuss results of high speed wind tunnel research on drag of single and double wing flow forms with Richard Hays, Aerodynamics Department head (standing), and Aerodynamicist Ronald Richmond (seated right).

## Lockheed Expands Aerodynamics Staff

With five prototypes already in or near flight test, Lockheed's Aerodynamics Division is expanding its staff to handle greatly increased research and development on future aircraft in commercial and military fields.

The five prototypes, which show the breadth and versatility of Lockheed engineering, are: The XP-104 supersonic air superiority fighter, XPV-1 vertical wing fighter, C-130 U.S.A.F. turbo-prop cargo transport, RTV-2 U.S.N. turbo-prop Super Constellation transport, and an advanced jet trainer of the T-33 type.

New projects now in motion are even more diversified and offer career-minded Aerodynamics Engineers and Aerodynamicists unusual opportunity to create supersonic inlet designs for flight at extremely high altitudes; switch human pilots with rapid outflows of supersonic aircraft at low altitudes; develop boundary layer control systems for safe take-off and landing of fighters and transports; remove adverse reversal and tail flutter problems incurred in high-speed flight through analysis and design; participate in determining configurations of turbo-prop and jet transports and advanced fighters, interceptors and bombers.

### To Aerodynamicists now interested in these problems Lockheed offers:

increased salary rates now in effect; generous travel and moving allowances; opportunity to enjoy Southern California climate and an extremely wide range of employee benefits which add approximately 14% to each employee's salary; a wide range of insurance, retirement pension, sick leave with pay, etc.

You are invited to write R. W. De Looper for an application blank and brochure describing life and work at Lockheed.

**LOCKHEED** AIRCRAFT CORPORATION  
BURBANK CALIFORNIA

service and shipping facilities.  
Scott Aviation Corp., 275-P Elm St.,  
Lancaster, N. Y.

### Production Driving Tools Speed Insert Placement

High volume production is speeded by the use of two new precision driving tools which are specifically designed for placing inserts.

► **Wide-Throat Tool-Strong**, permanent threads can be driven in aluminum, steel, magnesium, plastic, copper and wood with a tool that can provide threads from No. 4 to 4 in. without, coarse and fine, with a few quick changes in tip or driving end.



AIR OR ELECTRICITY power must drive.

The tool is powered either by air or electricity, can be used as a portable device or held in a drill press or universal holder. As many as six of the tools held in a special fixture can be utilized simultaneously. Depth of drive or placement of insert can be controlled to within 0.005 in., the maker notes.

► **Rouse Tool-Rouse** inserts and studs can be installed to precise depths at high speeds using a new tool guide by that company. Top of the tool or the insert's serrated collar is located to the



TOOL INSTALLS inserts to precise depth.



Most rigorous hose tests with MIL-L-7808 oil confirm high performance



Impulse test	no failures
fluid immersion + high ambient temp. test	no failures
circulating hot oil test	no failures
burst pressure or high temp.	7500 to 7700 psi
thermal shock	no failures

\*Certified trademarks for GE, Ingersoll-Rand, and others.

**FLUOROFLEX®-T R-2000** hose assemblies offer permanent plumbing designed for any existing oil...and those to come

At 400°F, this lightweight "flexible piping" is still wholly unaffected by any of the MIL-L-7808 synthetic oils or JP-4 fuels, aromatic fuels, petroleum oils. Moreover, it suffers no change in flexibility even down to -200°F, or after extended service.

These Fluoroflex-T top quality hose assemblies usher in a new concept in aircraft plumbing—permanent lines, no matter what the fluid conveyed. They also withstand vibration, take up misalignments, offer better fatigue strength and are easier to install than rigid or all-metal construction.

Stainless steel wire braid reinforces the Fluoroflex-T (Teflon compound) tube. Specially designed fittings assure blowout-proof connections. Full in situ specifications and tests in Bulletin FTE-2—send for your copy.

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**RESISTOFLEX CORPORATION**  
Belleville 5, New Jersey



## HELICOPTERS!

*Just as far as you can see!*

*And with our precision gears  
they do the most amazing things!*



A lot of the performance in terms of smooth even power is due to the precision-made Rotor Transmission Manufactured by the Steel Products Engineering Company for the Bell Aircraft Corporation.

For 35 years we have been designing and producing gears, gear assemblies, and other components which have the highest possible precision characteristics.

**THE STEEL PRODUCTS ENGINEERING CO.**

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desired depth of the parent material by the tool's pneumatic adjustment feature.

Rapidly convertible to drive either an auger or a thread and adapted to unusual sizes of vertical columns, the shank of the device fits standard drill chucks and can be used in any drill press or hand power tool without special attachments. It is said to be capable of operating at all spindle speeds.

Korn, Inc., 2501 West Coast Highway, Newport Beach, Calif.



**ONE BUTTON** operates all operations.

### Quick-Loading Fixture Speeds Welding Output

Highspeed welding of radiant and metallic parts, deep tanks and pressure vessels is made possible by a fixture that provides complete shielding or swinging away of its parts to allow the operator to refill them to be welded. End pressure and expanding members also are useful in assuring alignment of abutting edges, the maker notes.

Pushing one button on a control panel automatically sequences all operations. Individual control buttons shift, stops or reverses any operation. There is quick changeover for retooling without other disassembly or portions of welds.

Acting Welding & Engineering, 735 North Prairie Ave., Hawthorne, Calif.

### ALSO ON THE MARKET

Nylite nylon sleeves for bolts, screws and nuts are said to reduce failures due to vibration, eliminate electrolytic corrosion and produce a self-powder seal. The sleeve, which utilizes nylon's cold flow properties, is said to function as a lock, washer, and may increase shear strength of fastenings.—Kynstar Plastics, Inc., 2333 Morris Ave., Union, N. J.

Miniature breakers, precision made to plus or minus 0.001 in., are said to clean small holes faster and better than air blast or near. Breakers, called Mini-Breakers, are available with breaker made of stainless steel, steel, brass, nylon or long lasting—MILBraz Co., 7887 E. 59th St., Cleveland 3.

## How to use pneumatics in aircraft

### FOR ONE SHOT EMERGENCY POWER



From one shot operations like canopy removal or pilot ejection, you can get a ready source of power with high-pressure air. And you'll save weight and space in the cockpit.

The diagram above illustrates the simplicity of the system. All that's needed is a bottle of air, a Westinghouse Control Valve to regulate the flow of air, and a Westinghouse Operating Cylinder to supply the power. These devices are small and lightweight, and have been proved rugged and dependable in actual aircraft service. You can use them at pressures up to 3,000 psi. They operate perfectly at any temperature from 60° below zero to 350° above!

When you need reliable control of intermittent power—for landing gear, brakes, canopy doors, or other operations—think of Westinghouse Pneumatics. They have been used for years in all types of modern aircraft, and they'll do a job for you. Write for specific information.

## Westinghouse Air Brake COMPANY

INDUSTRIAL PRODUCTS DIVISION  
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Philadelphia, Pennsylvania, New Haven, Conn. — See your local distributor.  
Distributors in Canada by Canadian Pneumatic Co., Ltd., Toronto, Ontario.

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## The Tandem-Rotor BELL HSL-1 Helicopter

A Bell-developed prototype enables this advanced helicopter and later to carry out long periods of time while hovering in flying coast.



### NORDEN Precision Reduction Gear Box

It is the performance of a bell helicopter.

When also possible at maximum efficiency and maximum speed, the reduction gear box is a key component in the design of a helicopter. It is a key component in the design of a helicopter.



### PERFORMANCE

Reduction ratio is 20:0000. It has been tested without auxiliary performance. Friction is almost without sliding even the greatest reduction requires less than .01 in.-in. of input torque. Asynchronous tests of only one in production indicate loads of less than 0.05" at the output. All gears for a gear box with a 20:0000 reduction weigh only 6.5 cents and is contained within an area 5.5" x 5.5" x 5.5" exclusive of mounting flange.

### COMPONENTS

Materials used for gears and pinions are dependent upon the respective requirements for each factor as average life expectancy, reduction ratio, operational speed, and torque. The same considerations of requirements are given in determining bearing materials and/or the size and type of precision ball bearings to be incorporated. Lubricants are selected for specific purposes (high speed and maximum protection against corrosion. The cost, strength, and weight of materials are chosen for maximum efficiency, maximum weight and relative costs.

With the ever increasing demand for precision products ranging from the smallest gear available to the largest, Norden Precision, Inc. has been able to meet the demand. The same standards have become more and more familiar to the Norden people, no challenge is too great.

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## WHAT'S NEW

### New Publications

Bibliography of more than 250 technical reports dealing with Helicopter (NTR-150) may be obtained from Office of Technical Services, Dept. of Commerce, Washington, D. C., for \$9 cents.

Defense Dept. has issued a guide to help industry in supplying its plants to spend recovery from damage, fire, explosion, sabotage or enemy attack. Title: Industry Guide to Planning for the Restoration of Production Order from Government Printing Office, Washington, D. C. Price is 15 cents.

AGARD Memorandum, Defense Finance in the Laboratory, is a review of paper jobs from the University of Glasgow delivered before Agard Commission Panel in May 1956. It is distributed in this country by NACA, 1512 17 St., NW, Washington 25, D. C.

For workers in the fields of pure and applied mathematics, National Bureau of Standards has published Table of the Gamma Function for Complex Arguments, 1951 pages, \$2.00. Order from the Government Printing Office.

Government-owned inventories in metal, machinery and transportation fields are listed in Metal Processes and Apparatus, Machinery, and Transportation Equipment, which contains 657 technical brief descriptions. Book is available from Office of Technical Services, Dept. of Commerce, Washington 25, D. C. Order number is PS 111-167, price is \$2.50.

### Telling the Market

Potter & Johnston Co., has published 24-page brochure, entitled M Practical Production Ideas, showing how 100 equipment and requirements can make output and cut costs. Write: P. C. Johnston, Potter & Johnston Co., Newport Ave., Portland, R. I. . . . Pot & Johnston, West Hartford 1, Conn., describes its Model 35 Electronic 35 pages in new 8-page brochure. The 35 is similar to 2N's 45 (described in the largest precision jet motor ever built), only smaller. . . . How Industrial Research Laboratories can outstand cutting to produce high-throughput status and design is described in a brochure available from the company, 901 E. Shuman Ave., Los Angeles.

### New Address

New York Processors Distributor has moved to 111 E. 14th St., New York, N. Y. Phone: Sping 7-4100.

## Phil-trol

### Standard Plug-In and Dust Covered Relays Now Available in Three General Types

#### Lock Base Holds Relay System Firm, Removing Stress From Plug

The universal demand for a plug having the proper features and a well secured fastener has created need for the following design. This design is now available in the three basic lock-base-relay systems illustrated—namely, types 1, 2, & 3. The design consists of a plug-in arrangement having many different combinations of plugs, from 4 to 28 contacts per relay, and is equipped with a lock, which must be secured by two screws, thus removing the stress from the conducting plug. The cover assembly itself is fixed over a divider, which is so designed to prevent the contacts of the relay, eliminating the possibility of damage to contact springs when the cover is either removed or replaced. The cover is held in place by means of a knurled nut or screw, and is securely fastened against a rubber gasket. This design system maintains a close contact that will not slip and provides uniformity of mating.



The Phil-trol type 2QA (Quick Acting) relay, shown above, is commonly known as the standard plug-in type, permitting fast change and opening of a minimum number of contacts. Its long-coil construction permits use of high resistance coils. The late delay model, known as type 150 (long-operating), and 350 (long-released), are also available, providing time delays of as much as .050 sec. and operate over 500 second cycles. The plug-in cover arrangement is also available for the 2AC relay.

## Data for Relay Users

New PHIL-TRON Miniature Micro Switch Relays Now Available  
Compact snap-action contacts of the miniature variety are utilized in the new type 4MS and 4BMS series relays.



The Phil-trol type 2QA relay is commonly utilized, right compact from the type 2QA, and has similar performance characteristics.



#### Type 4MS Relay Assembly

This assembly, shown, features a fast, light weight, highly sensitive and low cost standard unit, with Micro Switch type V5-45, operating at approximately 1/2 watt power input. It may be organized to operate at 100 to 500 cps. Available SPT or SPTD. Contact mechanism out of cover type.



#### Type 4BMS Relay Assembly

This unit features and provides for as many as four miniature Micro Switches on one side of the 1/2 Type 150 L, rated at 1/2 watt, 250V A.C., in model 350. No removal of cover type provided.



The Phil-trol type 2QA (Quick Acting) relay, shown above, is commonly known as the standard plug-in type, permitting fast change and opening of a minimum number of contacts. Its long-coil construction permits use of high resistance coils. The late delay model, known as type 150 (long-operating), and 350 (long-released), are also available, providing time delays of as much as .050 sec. and operate over 500 second cycles. The plug-in cover arrangement is also available for the 2AC relay.



## Phillips Control Corporation

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advantage. This, coupled with speeding forecast and weather plans, increased dependability and reliability, and expansion of fleet, points to even heavier penetration of the railroad passenger market.

Other traffic potentials of major consideration include the growing population shift in this country to the West and Southwest; the general trend toward decentralization in industry and the steadily rising standard of living.

Taken together, they indicate a bright outlook from the standpoint of growth. General interests facing stress is to that, if the low-level problem can somehow be compressed, there will be no limit to this growth in all categories.

## NEA's Turner Heads Air Traffic Conference

Robert L. Turner, vice president of Northeast Airlines, has been elected president of the Air Traffic Conference of America. The successful Charles R. Sperr, American Airlines' senior vice president, was president-elect.

Arthur F. Kelly, vice president for Western Air Lines, and R. H. Beatty, Beatty International Airways' sales chief, were named first and second vice presidents respectively.

► **Increased Seats**—Among major items discussed were an American Airlines plan for a possibly serious fare schedule passengers and a transcon charge proposal by National Airlines.

NAL's proposal involves selling each passenger one ticket for travel over the lines of the carrier or carriers involved and a separate ticket for reserved space on the airline.

► **Charge Forfeiture**—In the event of cancellation or no-show by the passenger, the airline would retain the ticket charge, but the passenger would forfeit the maximum charge.

NAL hopes for industrywide adoption of the plan, realizing that one airline could not maintain it effectively.

## Board Approves New Swissair Service

Swissair has obtained new service points in a Civil Aeronautics Board assessment of the Swiss airlines' foreign air carrier permit.

The assessment's preliminary report is "in point or points" at Zurichland, after two having terminal points to Geneva and Zurich, and adds Manchester, England, as an intermediate point.

The amended authority now permits Swissair to offer service between Swiss ports, Frankfurt via Metz, Manchester, Shannon, The Azores, Gander and New York.



R. B. STEWART



JOSEPH J. O'CONNELL

## Employees May Buy Lake Central

By Katherine Johnson

The first employee-owned airline in the history of the scheduled air line, post industry will be introduced if Civil Aeronautics Board approves a proposed plan for organization of Lake Central Airlines.

Outlook for approval appears highly favorable.

The plan, to be submitted to CAB soon, also contemplates active local participation by business, financial, publishing and civic interests in the several cities along the local routes. The plan also includes the acquisition of the Indiana-Ohio-Elkhart route.

► **\$320,000 Down Payment**—Highlights of the organization proposal to be made to CAB:

► **LCA's employees** would purchase the total company stock of 50,974 shares at \$1 a share. They would buy 25% of the stock, or approximately \$120,000 worth, outright.

The remaining 75% of the purchase would be financed by a loan from an Indianapolis bank, with employees agreeing to repay the loan, either by salary deduction or direct payments, over a period of 10 months.

The employee purchase price represents nearly as much as needed.

► **Lake Central stock** would be controlled during the interim period by a new voting trustee. He is Joseph O'Connell, former Civil Aeronautics Board chairman (1948-49). Before the CAB appointment, O'Connell was general counsel of the Treasury Department. He now is a member of the Washington law firm of Chapman, Boyce, Walsh & O'Connell.

► **Board of directors** will be enlarged to as many as 17 members to make it broadly representative of local interests

and will include at least one employee representative. The present membership is four. The expansion is in line with the persistent requests of CAB members for civic support and responsibility for local service airlines.

CAB member Joseph Adams says there should be "as many or as few" types of local companies for the local lines.

One selection for the new Lake Central board: Gene Duffield, assistant to the publisher of the Cincinnati Enquirer, serving one of the most traffic routes of Lake Central's system. Duffield recently was chief of the Washington bureau of the Wall Street Journal and later served as special assistant to the late James Forrestal, former Secretary of the Navy and the first Defense Secretary.

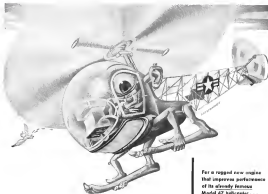
► **Refinancing program** would give Lake Central \$150,000 working capital to improve its position and could bring The Airlines now in three to four months behind in paying bills.

An Indianapolis bank would assume \$200,000 of LCA's indebtedness and advance the company a \$500,000 loan, with its assets (CAB's) transport as security.

► **North Central Bid**—One hurdle to accomplishment of the new Lake Central organization plus is the possibility that CAB will approve a pending proposal and order acquisition of LCA by North Central Airlines. This possibility is considered remote.

North Central serves the Michigan-Minnesota-Wisconsin area adjacent to Lake Central's territory.

Employees who buy stock under the employee ownership plan, however, would not lose on a stock sale to North Central should the acquisition be ordered by CAB. NCA's purchase



## New "vitals" for this Korean air vet

This battle-proven hero of 15,000 ground troops over Korea is now supercharging itself—now powered by Lycoming's 250-C 40-45 engine.

With the superior power plant, both the Model 47 and its sister ship—the 4-Place Utility 47G-1—will fly faster and higher in all weather... and require less maintenance.

Such performance improvement is but one of many Lycoming contributions to air combat power.

Can you use superior air combat power... or any other of the diversified services listed at the right of our signature? If both or your problem... look to Lycoming!



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POSITIONS ARE OPEN in several fields with salaries based on  
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Physicists	Civil engineers
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Openings also exist for personnel with ability and experience in  
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region of northeastern Ohio. Cosmopolitan living, year-round  
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qualifications, or requesting an application form.

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## A Significant Experiment

Civil Aeronautics Board will be gathered shortly to approve financing and reorganization of Latin Central Airlines, a Montreal local service carrier, to permit sale of stock to employees and the public in the company's new era.

This striking new idea, outlined in a story on page 166 at this time of American Wings, seems tailor made to meet the well-publicized demands of certain members of the Board itself the past year or so. These government officials have wanted the local service or "feeder" airlines that they must rally the solid support of their constituents on a "use the service or lose it" basis. Otherwise, in some areas, there is little hope that the small lines can build up traffic, cut subsidy requirements and obtain a sound economic basis.

It is encouraging that the plan is being supported by Joseph O'Connell, with experience as a former chairman of CMB, and earlier in general counsel of the U. S. Treasury Department. Mr. O'Connell, as an intense voting trustee, would control the stock until permanent management is established.

We hope the plan is forced around enough to be approved by the Board and that it gets a fair trial as the first project to secure employee-owned status in the United States.

It is difficult to conceive a plan more likely to arouse maximum possible support from employees and non-employees than this one. Its approval will launch a significant experiment in commercial air transportation.

## The Public Will Win

Never have we seen anything to equal the white hot competition raging now among manufacturers of commercial transport planes.

The battle for airline contracts—and possible military transport orders for the best products—goes on both sides of the Atlantic—American vs. British, and American vs. Russians.

There is not a moment to lose. Despite the fact that Cessna's only loss, the tragic accident last December brought commercial failure. Along came Boeing with its jet 707. That advance drove other U. S. manufacturers' plans for jet transports, although there are several on the boards.

The scene suddenly turns to turboprops, and British Vickers surprises the aviation world by selling Capital Airlines a big four-to-six seat turboprop at once as this coming spring.

Boeing tops its piston engine DC-7, already the fastest American transport, with another surprise—the large-engined jet DC-7C, and discloses some orders. Lockheed cleans up its Super Constellation to the maximum, agrees with a military backlog that arouses considerable interest, and now releases a newer, faster, longer-range, three-engine turboprop commercial edition that its creation hope will offset the DC-7C or anything else, except entries in the piston category. Lockheed hopes to win the turboprop prize, and somewhat those offset contracts a while longer.

Meanwhile, there are other plans under consideration that would utilize various British or American turboprop power installations in existing American transport with a minimum of construction changes.

It's a hot house race, with the leaders changing places constantly. Those who are betting on an outcome at this early stage are risk individuals, indeed, and they probably are experienced investors of aviation, because decisions now there is really no outcome in the winning business—but constant change and improvement is a race that never ends.

The public and national security are the real winners in all this. That is the way it should be.

## The Von Karman Award

The unanimous decision of a distinguished committee to award the 1954 Wright Brothers Memorial Trophy to Dr. Theodore Von Karman is a fitting choice.

The trophy is bestowed each year for "significant public service or a civilian of enduring value to aviation in the United States."

This year's citation, accompanying the trophy, to be presented in Washington at a dinner on Dec. 17, declares that "his other work has had a greater influence on the development of high-speed aircraft in the United States."

Basic contributions Dr. Von Karman has made to the development of supersonic research and operational aircraft include those:

- First theory of supersonic drag in 1935.
- First supersonic wind-tunnel project in the U. S. in 1936.
- Conception and development of jets to the point of practical application.

Initiation of the first Air Force jet propulsion and rocket motor development project at the California Institute of Technology in 1938.

• Presentation of the first comprehensive theory of supersonic aerodynamics, considered the "seminal work," in 1946.

Dr. Von Karman is now in Europe as chairman of the Advisory Group for Aeronautical Research and Development under NATO and also is chairman of the Air Force Scientific Advisory Board. A native of Hungary, he was educated at the Royal Technological University in Budapest and received a doctor's degree in engineering from the University of Göttingen.

Members of the committee which unanimously selected Dr. Von Karman were:

Thomas G. Leighton, vice president of Constellation and president of National Aeronautics Assn.; S. Paul Johnston, director of the Institute of the Aeronautical Sciences, Aero-Division C. Ramsey, president of Aerojet Industries Assn.; Brig. Gen. Milton Arnold, vice president of Air Transport Assn.; Joseph O'Connell, former chairman of the Civil Aeronautics Board; Dr. Hugh Dugan, director of the National Advisory Committee for Aeronautics; Ralph Flatt, immediate past president of the Aviation Writers Assn.

—Robert H. Wood



## A STORY WORTH REPEATING

During the past years, our advertising has emphasized and re-emphasized one significant fact. For over thirty years, Bendix Products Division of Bendix Aviation Corporation has employed the largest group of trained specialists in the fields of fuel metering, landing gear, wheel and brake equipment to be found anywhere in the aviation industry.

It is indeed a story well worth repeating for obviously one of the vast reservoirs of specialized experience can come lower designed products, lower cost and on schedule production.

It is in fact the principal reason why leading air frame builders and engine manufacturers turn to Bendix Products for the best solutions to their fuel metering, landing gear, shock absorbing areas, wheel and brake problems.

**Bendix**  
Products  
Division

LANDING GEAR Shock absorbing areas, wheels, brakes, hydraulic steering. Gyroscopic brake loop.

ENGINE EXHAUSTS Fuel metering controls for gas and vapor turbine engines and diesel type carburetors, direct fuel injection systems.



Lockheed 1049 G Super Constellation Transport

### Lockheed's New Tiptanks Increase Non-Stop Service Range

Wingtip fuel tanks, like those on the test plane above, are now available on all Lockheed 1049G planes to extend the normal flying range for passenger airliners up to 4620 miles. The two teardrop-shaped tanks, holding 600 gallons of fuel each, provide up to 850 miles more range for increased nonstop service across the Atlantic and on other long-distance air routes.

Whenever aviation advances, Reynolds Aluminum advances with it. Every step in Reynolds production is geared to the requirements of the constantly progressing aviation industry.

Reynolds goes beyond meeting rigid material specifications. Reynolds technical services make a continuing contribution to customers' design and engineering staffs—make Reynolds a *part* of the aircraft industry rather than just a supplier.

Write the Reynolds Metals Company, 2559 S. Third Street, Louisville 1, Kentucky. Ask for full information about how Reynolds can serve you.

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